7

Very Light Jets

These aircraft are determined as Very Light Jets because of their weight or useful load factors but prefer to be described by most of the OEMs as Entry Level jets. They certainly feature everything expected of a business jet by corporate flight departments. Deliveries of business jets in this segment are poised to accelerate rapidly off a base of around 100 units in 2006 averaging just under 250 aircraft per year over the next 10 years, reflecting the introduction of new VLJs, such as the Embraer Phenom 100 and Cessna Citation Mustang, both of which already enjoy a strong order backlogs.

■ Raytheon's Beechcraft Premier IA is one of the aircraft already bringing in the orders for the VLJ sector. The aircraft was the first all-composite fuselage business jet to enter service.
Artists: Giussepe Picarella and David Hatchard

BEECHCRAFT PREMIER IA

SPOTTER'S GUIDE

The low swept wing is mounted below the fuselage. There are three cabin windows a swept T-tail and swept tailplane. The Williams engines are rear mounted on either side of the mid fuselage.

SPECIFICATION

Length	46'	14.02m
Wingspan	44' 6"	13.56m
Height	5' 5"	4.69m
Cabin Length	13' 6"	4.17m
Cabin Width	5' 6"	1.68m
Cabin Height	5' 5"	1.65m
Max Range (4)	1,314nm	2,434km
Max Seating	2 + 6	
Typical Seating	1 + 4	
Powerplant	2x Williams FJ44-2A	2,300lb/10.23kN each
Avionics	Rockwell Collins Pro Line 21	
Max Cruise Speed	456ktas	845km/h
Max Ceiling	41,000ft	12,497m
Rate of Climb	3,800fpm	1,158mpm
Take off Distance	3,792ft	1,156m
Landing Distance	3,170ft	966m
MTOW	12,500lbs	5,670kg
Max Landing Weight	11,600lbs	5,262kg
Useful load	4,160lbs	1,887kg
Payload with full fuel	490lbs	222kg
Price	$6.06m	€4.73m

THE six-passenger Premier IA is the first composite-fuselage business jet. This state-of-the-art construction method, combined with a metal swept wing, provides faster cruise speed, better altitude performance, superior handling and a cabin size that is seven inches taller and eight inches wider than competitive entry-level business jets.

The performance figures for the aircraft are outstanding with a maximum speed of 451ktas (835 km/h). With full fuel, one pilot and three passengers, the Premier I has a 1,450nm range.

Operating for charter companies in Europe such as the UK's Club 328, the Premier IA has cabin comfort more in line with a mid-size jet and features include improved temperature control and table storage with 110 VAC outlets and provisioning for the optional Satcom flight phone.

As well as an integrated Rockwell Collins cabin entertainment system with CD/DVD and Airshow capability.

Up front the Premier IA has Rockwell Collins Integrated Flight Information Systems (IFIS) as part of its ProLine 21 avionics suite. This advanced upgrade offers Premier IA pilots a wide range of safety and situational enhancing information to include map overlays (airways, airspace, geopolitical) as standard features.

The Premier IA is powered by two Williams/Rolls FJ44-2A engines.

HERITAGE

The Beech 390 series began as a concept in the early 1990s and was launched at NBAA in September 1995 as the Raytheon Premier 1 – the first to only feature the Raytheon name. It first flew in December 1998 and entered service in March 2001. The following year it reverted to the Beechcraft name. At EBACE in Geneva in May 2005, Raytheon unveiled the upgraded 1A and it was certified in October that year.

NEW

CESSNA CITATION CJ1+

HERITAGE

The CJ series evolved from the Citation 525 prototype that spawned the CitationJet which Cessna launched at NBAA in 1989. First flight occurred on April 29 1991, FAA certification was awarded on October 16 1992 and the first delivery was on March 30 1993. At 1998 NBAA convention Cessna announced development of an improved CJ1 to replace the CitationJet – the latest improvements to make CJ1+ happened in 2006. EASA certification was awarded in July.

SPECIFICATION

Length	42' 7"	12.98m
Wingspan	46' 11"	14.30m
Height	13' 9"	4.19m
Cabin Length	11'	3.35m
Cabin Width	4' 10"	1.47m
Cabin Height	4' 9"	1.45m
Max Range	1,300nm (full fuel MTOW)	2,408km
Max Seating	2 + 7	
Typical Seating	1 + 4	
Powerplant	2x Williams FJ44-1AP	1,960lb/8.72kN each
Avionics	Rockwell Collins Pro Line 21	
Max Cruise Speed	389KTAS	720km/h
Max Ceiling	41,000ft	12,497m
Rate of Climb	3,290fpm	1,003mpm
Take off Distance	3,250ft	994m
Landing Distance	2,590ft	789m
MTOW	10,700lb	4,853kg
Max Landing Weight	9,900lb	4,490kg
Useful load	3,835lb	1,740kg
Payload with full fuel	615lb	279kg
Price	$4.24m	€3.31m

UNTIL the certification of the Citation Mustang, the Citation CJ1 was the first step up the ladder of Citations, now with the "plus" suffix, signifying improvements to the avionics and the engines, this is very much a powerful contender in the burgeoning VLJ/entry-level business jet market

The "plus" improvements have been quite significant with the derivative able to climb and cruise faster than the original but weighs less.

It is also able to operate on shorter runways in hot and high conditions.

The CJ1+ includes the Rockwell Collins ProLine 21 along with the Collins Flight Management System (FMS) replacing the Honeywell Bendix/King radios and Universal FMS found in the CJ1 and CJ2.

Even more important for the subsequent weight changes was the introduction of FADEC.

Not only did this simplify the workload for the pilots it also meant Cessna could remove the thrust attenuators thereby reducing weight and easing thrust control for pilots.

The CJ1+ has new advanced engines, featuring a pair of Williams FJ44-1AP turbofans providing 1,960lbs (8.72kN) of thrust.

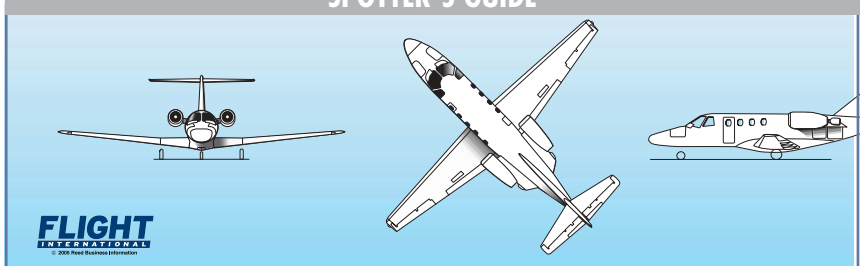
The enhanced Rockwell Collins avionics package gives both light jets the feel of a much bigger aircraft.

Standard equipment includes:

- three 10" x 8" (240mm x 192mm) LCD screens featuring dual digital flight guidance computers;
- dual solid-state attitude heading reference systems, dual RVSM compliant digital air data computers;
- a single, three-axis autopilot;
- dual sets of the Pro Line 21 comm, navigation and surveillance radios;
- a multi-sensor FMS 3000 with 12-channel GPS receiver;
- weather radar and XM radio data link weather receiver as well as the L-3 Communications' Skywatch HP TCAS-1, Landmark TAWS;
- and an integrated standby instrument system.

Cessna's whole CJ series is certified for single pilot operation.

SPOTTER'S GUIDE



A CitationJet forward fuselage is mounted to a T-tail configured tailplane and a new supercritical laminar flow wing. The Williams FJ44 turbofans (with paddle thrust reversers) are mounted aft. A useful differentiator against other Citations is that CJ1 and CJ1+ have four windows.

SPOTTER'S GUIDE

The extra three feet of cabin (leading to an almost 48' fuselage) is shown by the two additional windows over the CJ1+ . A longer tail cone area is used for baggage.
The Williams engines are mounted aft, mid fuselage. Like the CJ1+ it has straight low wings and a T-tail.

SPECIFICATION

Length	47' 8"	14.53m
Wingspan	49' 10"	15.19m
Height	14'	4.27m
Cabin Length	13' 7"	4.14m
Cabin Width	4' 10"	1.47m
Cabin Height	4' 9"	1.45m
Max Range	1,613nm (full fuel MTOW)	2,987km
Max Seating	2 + 6	
Typical Seating	1 + 6	
Powerplant	2x Williams FJ44-3A-24	2,490lb/11.08kN
Avionics	Rockwell Collins Pro Line 21	
Max Cruise Speed	418KTAS	774km/h
Max Ceiling	45,000ft	13,716m
Rate of Climb	4,120fpm	1,256mpm
Take off Distance	3,360ft	1,024m
Landing Distance	2,980ft	908m
MTOW	12,500lb	5,669kg
Max Landing Weight	11,525lb	5,227kg
Useful load	4,700lb	2,132kg
Payload with full fuel	770lb	349kg
Price	$5.75m	€4.49m

CHARTER operators are finding the CJ2+ is giving them just that little extra bit of aircraft.

A cabin that is three feet longer than its sister aircraft, the CJ1+ gives one extra passenger seat bringing the total to six.

Like the smaller CJ1+, the CJ2+ includes the Rockwell Collins ProLine 21 along with the Collins Flight Management System (FMS) replacing the Honeywell Bendix/King radios and Universal FMS found in its predecessor the CJ2. This also has FADEC.

The enhancements have led to greater performance, upping the zero fuel weights, improved payload, and increased range by around 50nm (1,613nm, 2,987km for the CJ2+) but the most impressive difference is the climb – the CJ2+ can now climb straight to its ceiling of 45,000ft in just 28minutes.

The CJ2+ is powered by two Williams FJ44-3A-24 engines offering 2,490lbs (11.8kN) of thrust giving a cruise speed of 412ktas.

The Citation CJ1+, CJ2+ and CJ3 are manufactured on the same production line, allowing Cessna to build these airframes on the same tooling.

This lean manufacturing practice allows Cessna to adjust Citation CJ1+, CJ2+ and CJ3 production rates more efficiently, and deliver airplanes to customers with shorter lead times.

HERITAGE

The CJ2+ is an enhanced CJ2 which itself grew from the successful CitationJet programme (see Citation CJ1+) The Citation CJ2+ was announced at the 2004 NBAA show. The CJ2+ received U.S. Federal Aviation Administration certification less than a year later on October 3, 2005, after 80 flights and 190 flight hours and EASA certified the aircraft in July 2006.

NEW

CESSNA CITATION MUSTANG

SPOTTER'S GUIDE

The Mustang has three windows on either side with an emergency exit over the central window over the starboard wing. It has low straight wings with a swept T-tail and high set swept tailplane.
It has a distinctive extended underbelly which allows the aircraft's remarkable spacious cabin. The twin PW 615F engines are mid-mounted on the rear fuselage.

SPECIFICATION

Length	39' 11"	12.17m
Wingspan	42' 3"	12.87m
Height	13' 9"	4.19m
Cabin Length	9' 9"	2.97m
Cabin Width	4' 7"	1.42m
Cabin Height	4' 6"	1.37m
Max Range	1,150nm	2,130km
Max Seating	2 + 4	
Typical Seating	1 + 4	
Powerplant	2x P&WC PW615F	1,350lb/3.01kN each
Avionics	Garmin G1000	
Max Cruise Speed	340 KTAS	630 km/h
Max Ceiling	41,000ft	12,497m
Rate of Climb	3,010fpm	917mpm
Take off Distance	3,120ft	951m
Landing Distance	2,610ft	796m
MTOW	8,645lbs	3,921kg
Max Landing Weight	8,000lbs	3,629kg
Useful load	3,180lbs	1,442kg
Payload with full fuel	600lbs	272kg
Price	$2.54m	€1.98m

FLIGHT departments and owner-pilots are looking with interest at the latest from the Cessna Citation stable, the entry-level Mustang.

The aircraft received certification for single pilot operations in early September – the first of the new breed of jets to achieve full certification. It has a top speed of 340ktas, a range of 1,150nm (1323 statute miles/2130km – NBAA IFR Reserves) and a service ceiling of 41,000ft (12,500m) – well suited for getting above weather and commercial traffic for more efficient operations.

The Garmin G1000 equipped aircraft will be one of the first to take advantage of WAAS navigation features including Lateral Performance with Vertical Guidance approach (LPV) and WAAS Vertical Navigation (VNAV). WAAS is a GPS-based navigation and landing system that provides precision guidance to aircraft at airports where there are currently no precision landing capabilities. The Mustang will also be one of the first aircraft certified with the Garmin SafeTaxi feature.

Pratt & Whitney Canada has received initial certification from Transport Canada for the dual-channel FADEC-controlled PW615F engines..

The Mustang is being built in Independence Kansas with 19 aircraft in production for delivery in 2007. With nearly 250 orders, the Mustang is sold out into the third quarter of 2009. Currently, about 60 percent of Mustang orders are from outside of the United States, with 30 percent from Europe. Other significant markets include South America and Australia.

HERITAGE

Cessna celebrates its 80th anniversary this year (2007) and throughout its history it has a record of innovation and working the market to meet its loyal customer needs. Cessna currently manufactures nine business jet models and is the only general aviation manufacturer to certify 11 new jets in the last 10 years. The Mustang is the first of its kind and bridges the gap between the Citation jets and the turboprop aircraft on offer from the Wichita based company. Mustang was launched at the NBAA convention in 2002 and first flew on April 23 (Cessna promised a May 2005 first flight and beat that schedule) It is designated as a Citation 510.

IN DEVELOPMENT

EVIATION JETS EV20 VANTAGE

SPECIFICATION

Length	40' 8"	12.39m
Wingspan	49' 1"	14.973m
Height	15' 4"	4.66m
Cabin Length	17' 3"	5.26m
Cabin Width	5' 5"	1.65m
Cabin Height	5' 2"	1.52m
Cabin Volume	372 cu.ft	10.53m3
Max Range	1,203nm	2,228km
Max Seating	2 + 8	
Typical Seating	2 + 6	
Powerplant	2x Williams FJ44-1AP	1,971lbs / 8.77kN each
Avionics	Garmin G1000	
Max Cruise Speed	427KTAS	790km/h
Max Ceiling	41,000ft	12,496m
Rate of Climb	3,000fpm	914mpm
Take off Distance	2,500ft	762m
Landing Distance	2,500ft	762m
MTOW	9,250lbs	4,195kg
Max Landing Weight	8,850lbs	4,014g
Useful load	4,200lbs	1,905kg
Payload with full fuel	1,450lbs	657kg
Price	$3.25m	€2.53m

ANOTHER VLJ is planned to begin development in the workshops in Brazil. Eviation's twin jet Vantage is moving from the drawing board to a prototype to replace the single engine prototype.

The manufacturer will make use of the low cost facilities in Brazil and certify the aircraft with CTA (Brazilian civil aviation authority) who has a bilateral agreement with the FAA.

The preliminary specifications suggest it is likely to offer a useful load of 4,200lbs (1,905kg) a maximum cruise speed of 427ktas (790km/h) and a ceiling altitude of 41,000ft (12,496m).

Eviation Jets have chosen the Williams FJ44-1AP to power the aircraft with 1,971lbs (8.77kN) of thrust and Garmin to provide the avionics with its G1000 suite.

It will have seating for ten occupants in high density but it is believed that a corporate interior will seat six in the relatively roomy cabin.

The fuselage design is essentially the original single engine version, but by removing the single engine from its internal positioning this has extended the fuselage and now offers a cabin length of 17' 3" (5.26m).

It is expected that the aircraft will have a range of 1,203nm (2,228km) and carry 1,450lbs (658kg) of passengers, crew and baggage.

Effectively this equates to six passengers and a single pilot at 200lbs (90.7kg) each and a 50lb (22kg) total baggage allowance.

HERITAGE

The Vantage was originally being developed by VisionAire, however after having spent $110m on development, the company went bankrupt.

The present version was purchased by an Iowa property developer who obtained the intellectual rights for $441,000 in October 2003.

The Vantage started life with a single Pratt & Whitney JT15D-5 but has evolved to feature two Williams FJ44-1APs.

Only a prototype of the single engine VisonAire version currently exists but the critical design review has been completed and the revised design prototype will follow soon.

SPOTTER'S GUIDE

The Vantage will feature a straight wing with a T-tail with swept tail fin and tail plane. It will have five windows on each side with the Williams engines mounted either side of the rear fuselage.

IN DEVELOPMENT

EMBRAER PHENOM 100

SPOTTER'S GUIDE

The Phenom 100 has a low, swept dihedral wing with a T-tail with a highly swept tailplane and a distinctive dorsal fin. The P&WC engines are mounted high on the fuselage to the rear. There are four windows on each side.

SPECIFICATION

Length	41' 8"	12.7m
Wingspan	40' 4"	12.3m
Height	14' 4"	4.4m
Cabin Length	11'	3.35m
Cabin Width	5' 1"	1.55m
Cabin Height	4' 11"	1.5m
Max Range (4)	1,160nm	2,148km
Max Seating	2 + 6	
Typical Seating	1 + 4	
Powerplant	2x P&WC PW535E	1,615lb/7.18kN each
Avionics	Embraer Prodigy	
Max Cruise Speed	380ktas	703km/h
Max Ceiling	41,000ft	12,497m
Rate of Climb		
Take off Distance	3,400ft	1,036m
Landing Distance	3,000ft	914m
MTOW		
Max Landing Weight		
Useful load		
Payload with full fuel		
Price	$2.85m	€2.22m

BRAZILIAN manufacturer Embraer is the fourth largest aircraft maker in the world and has a reputation for delivering great aircraft. The Phenom 100 is a VLJ that many analysts believe will raise the bar for the category.

It has all of the big business jet comforts. The Phenom's BMW-designed cabin is longer, taller and wider than its competitors which equates to more legroom, a wardrobe and a small refreshment area. It also features a conventional lavatory with a solid door rather than a curtained-off potty.

The aircraft also has 45 cubic feet of external baggage space, enough for golf clubs, skis or of course luggage and a further 10 cu.ft in the nose and cabin.

The Phenom 100 will be certified for up to eight people but the interior design best suits four in the cabin with two seats in the cockpit. It will be rated for single pilot operation.

The aircraft is powered by Pratt & Whitney Canada's PW617F engine, with 1,615lbs (7.18kN) of thrust giving a comfortable air taxi range of 1,160nm (2,148km) (NBAA IFR reserves with 100nm alternate) with four people onboard and it will have a maximum operating speed of Mach 0.7. The aircraft is designed for a short take off distance and is capable of flying at 41,000ft (12,497m).

Embraer anticipates the Phenom 100 will enter service in mid-2008.

HERITAGE

This is the first of its kind from Embraer. The company is also building a light jet, the Phenom 300 due in 2009. The company's record for reliability with its regional jet programme is outstanding and the company has offered a fixed fee maintenance programme. Embraer's entry into the light jet and VLJ markets was announced at EBACE in Geneva in May 2005 and the "Phenom" name unveiled at NBAA in Orlando in November 2005.

IN DEVELOPMENT

HONDAJET

HERITAGE

Honda began research in small business jets in 1986, the first aircraft was the Honda MH02 built purely as a technology test bed and was manufactured totally from composites. In 1999 Honda developed its own jet engine, the HF118 which was developed with General Electric as part of the GE Honda partnership. The engine was actually test flown on a Cessna Citation. The present HondaJet prototype first flew in December 2003.

SPECIFICATION

Length	41' 8"	12.7m
Wingspan	39' 11"	12.2m
Height	13' 2"	4.1m
Cabin Length		
Cabin Width		
Cabin Height		
Max Range	1,100nm	2,037km
Max Seating	2 + 4/5	
Typical Seating	1 + 4/5	
Powerplant	2x GE-Honda HF118	2,000lb / 8.9kN
Max Cruise Speed	420ktas	778km/h
Max Ceiling	43,000ft	13,106m
Rate of Climb		
Take off Distance	2,647ft	807m
Landing Distance	2,277ft	694m
MTOW	9,200lbs	4,173kg
Max Landing Weight		
Useful Load		
Payload with full fuel		
Price		

THE HondaJet is very much a work in progress, after its debut at Oshkosh in 2005 Honda proclaimed to have no plans to go into production - one year later at Oshkosh 2006 Honda announced it was going to pursue certification and production.

Honda has teamed with Piper to create a new premium dealer and service network to bring the aircraft to market and aims to have type certification sometime between 2009 and 2010. The over wing engine mounted design has been coupled with a natural laminar flow wing and nose – essentially this increases efficiency at cruise speed by reducing wave drag and surface friction drag with a high lift coefficient. It makes use of composite materials for the fuselage and preliminary performance specifications are promising. Honda claims that these aerodynamic design points and fuel efficient engines allow it to operate some 30-35% more efficiently than similar jets.

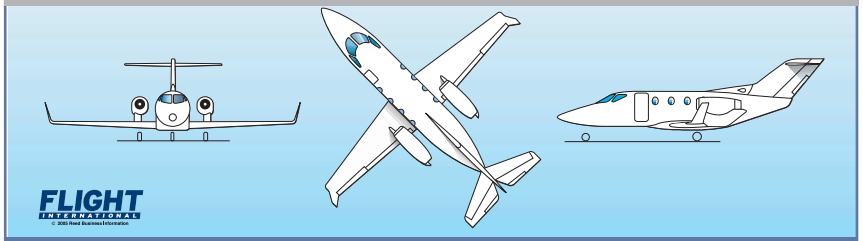
To date the prototype has completed more than 240 hours of flight-testing since July 2006 and has achieved an altitude of 43,000ft and a speed of 412ktas and is expected to meet or exceed all of its design specifications.

It is currently fitted with the Garmin G1000 avionics suite which comprises a primary flight display for pilot and co-pilot and a central multi-function display.

It will be powered by two GE-Honda HF118 turbofans delivering 2,000lbs (8.9kN) of thrust and be able to cruise at a maximum speed of 420ktas (778km/h). It is also expected that cabin noise levels will be lower due to the positioning of the engines and greater cabin space. The fuselage is constructed from a honeycomb sandwich structure and co-cured stiffened panels which reduce weight and manufacturing costs.

With a maximum take-off weight of 9,200lbs (4,173kg) places the HondaJet at the upper end of the VLJ category and could be comparable to the Cessna Mustang and Embraer Phenom 100. It is planned to have a range of 1,100nm (2,037km) and seat six or seven.

SPOTTER'S GUIDE



The Honda is obvious on the ramp because of the pod mounted engines above the wing. A T-tail and large winglets will also help to identify this jet.

SPECTRUM 33

IN DEVELOPMENT

HERITAGE

The Spectrum 33 is an all new composite eight seat business jet. Developed by Spectrum Aeronautical and its subsiduray Rocky Mountain Composites the two companies have developed the carbon fibre fuselage and wing by using a fibre-placement process called fibeX which helps to reduce weight. The Williams FJ33-4 powered aircraft was unveiled at NBAA in Orlando, Florida November 2005 and made its first flight from Spanish Fork to nearby Provo airport on 7 January 2006. US certification was scheduled for 2008.

SPECIFICATION

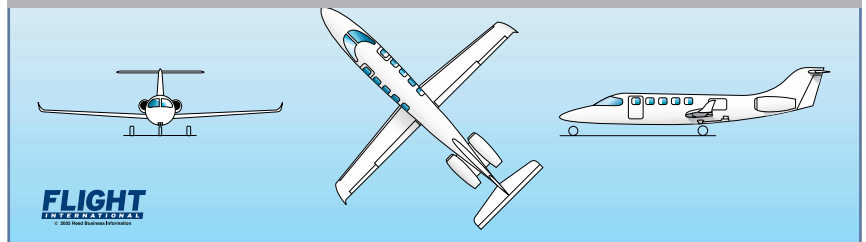
Length	45' 11"	13.99m
Wingspan	42' 1"	12.83m
Height	11' 8"	3.56m
Cabin Length	17' 6"	5.33m
Cabin Width	4' 10"	1.47m
Cabin Height	4' 10"	1.47m
Max Range	>1,750nm	>3.238km
Max Seating	1 + 9	
Typical Seating	1 + 6	
Powerplant	2x Williams FJ33-4	1,568lbs/ 6.97kN each
Avionics	TBC	
Max Cruise Speed	415ktas	768kmh
Max Ceiling	45,000ft	13,716m
Rate of Climb	5,082fpm	1,549mpm
Take off Distance	<3,000ft	<914m
Landing Distance	<2,700ft	<823m
MTOW	7,300lbs	3,311kg
Max Landing Weight		
Useful load	3,680lbs	1,669kg
Payload with full fuel	909lbs	412kg
Price	$3.65m	€2.84m

A MAJOR setback to the Spectrum 33 test programme occurred when the only flying prototype crashed on July 25 2006. Preliminary accident reports believe the crash to have been caused by a maintenance error and subsequently the flying controls were reversed after a redesign to accommodate strengthened main landing gear.

However, the preliminary specifications for the Spectrum 33 offer a good spread of capability. It is aimed to have an IFR range in excess of 1,750nm (3,238km) whilst being able to cruise at a ceiling of 45,000ft (13,716m) at a maximum cruise speed of 415ktas (768km/h).

The Spectrum team is focused on getting back on schedule and calculates that their light weight design is key to boosting fuel efficiency and that the 33 will have a fuel cost of $0.71/nm ($0.38/km). Although the 33 can seat a maximum of nine passengers its maximum take off weight is only 7,300lbs (3,311kg) however it still has a useful load of 3,680lbs (1,669kg) with a typical basic empty weight of 3,620lbs (1,642kg). The empty weight is comparable to piston engine twins such as the Piper Seneca V - 3,406 lbs (1,545 kg) or the Beechcraft Baron – 3,922lbs (1,779kg).

SPOTTER'S GUIDE



The Spectrum 33 has a T-tail and rear pod mounted engines. The wings have a high aspect ratio (the aspect ratio refers to the total span of a wing divided by the mean chord – where the chord is the length from the leading edge to the trailing edge) un-swept wing with winglets. Essentially high aspect ratio wings tend to be long and narrow, and low aspect ratios short and stubby. The 33 features five windows on each side and the cabin door is on the port side.