

**Overview of the Entry into Service of Part 23 Jets below 4,536 kg /  
10,000 Pounds Max Takeoff Mass (sometimes called “Very Light Jets”)  
including Single Pilot Operations, Training Program, and Operational  
Data**

**February 28, 2009**

**(Originally submitted as part of GAMA comments to NPA 2008-17)**

## 1.0 Very Light Jet Product Segment in Context

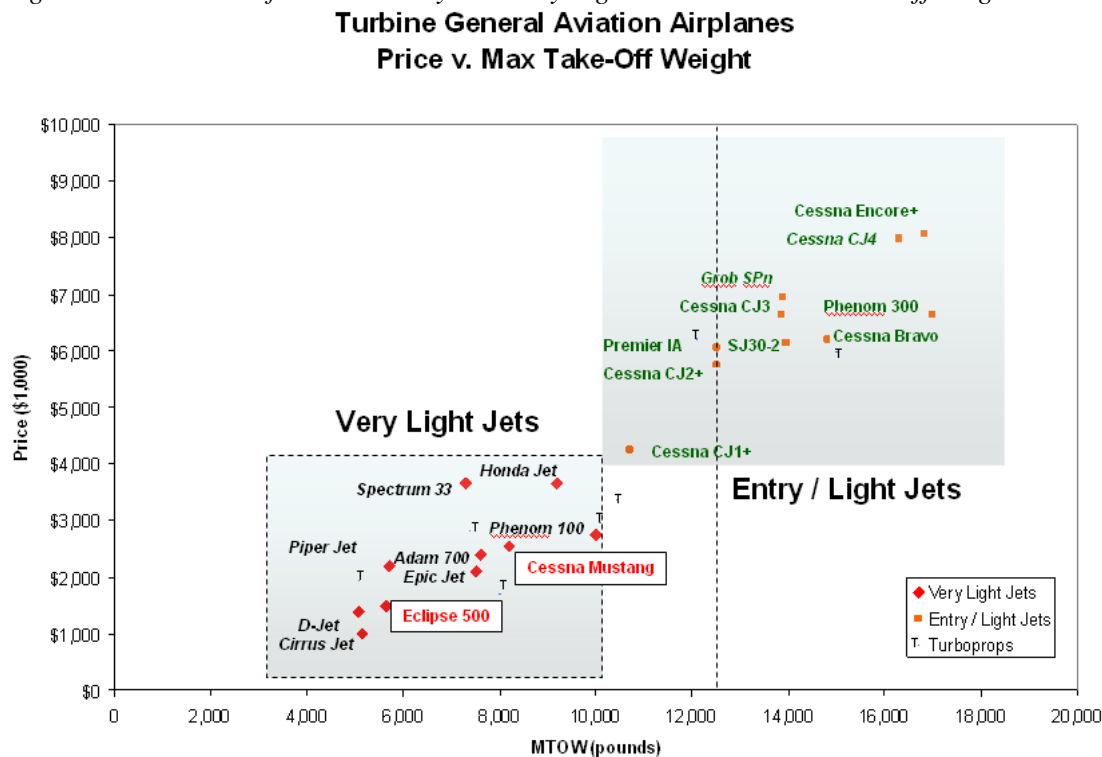
1.1 Very Light Jets (or “VLJs”) are commonly defined as the product market segment of business jets with a max takeoff weight below 10,000 pounds (4,536 kg) and purchase price below \$4 (€) million. The airplanes within this product segment are type certificated in accordance with 14 CFR Part 23 (EASA CS 23) requirements and special conditions applied by the FAA (and EASA) through the certification process. These airplanes can also be operated single pilot by a properly rated pilot.

1.2 The first two models type certificated within this product market segment obtained their certificates in late 2006 and entered into operations with customers during 2007. Through 2007, one-hundred forty-six business jets within the very light jet product segment have been delivered worldwide. In 2008, an additional 264 airplanes were delivered and an additional obtained type certification.

1.3 The expansion of the general aviation product market segment to include very light jets has created a great deal of interest and excitement. This new product segment provides the business jet customer flying experience at a price point approximately half that of the previous lowest product offerings in the business jet market.

1.4 Prior to the emergence of the “very light jet” product market segment, business jets were priced between \$4 million and \$50 million and had a max take off weight between 10,800 pounds (4,899kg) and 100,309 pounds (45,500 kg.) The very light jets have resulted in acquisition prices in the \$2.0-\$3.0 million range and MTOW between 5,000 pounds (2,270 kg) and 9,965 pounds (4,520 kg.)

Figure 1 – Overview of Current Entry and Very Light Business Jet Product Offerings



## 2.0 Introduction to Part 23 Jets and Single Pilot Operations

2.1 Single pilot jets and business jets type certificated under 14 CFR Part 23 (i.e. CS 23) are not something new. Since the 1970s, Cessna Aircraft Company have designed, certificated and placed into operation business jets that are capable of single-pilot operations including the Cessna 501 series to the more recent Cessna 525 Citation Jets. Hawker Beechcraft Corporation (“HBC” – formerly Raytheon Aircraft Company) has also been producing Part 23 single pilot certified jets, the Beechcraft 390 Premier I/IA, since 2001.

2.2 Since the first 14 CFR Part 23 (CS 23) jets were type certificated, the general aviation manufacturer industry has designed, certified and placed into service over 1,900 small jet airplanes worldwide.

2.3 Cessna Aircraft Company also has certificated the Cessna 501 and 551 Citations, which are transport category airplanes certificated in accordance with 14 CFR Part 25 (CS 25), as single pilot authorized. For the Cessna 550 and Cessna 560 (V, Ultra, and Encore models) transport category airplanes pilots can obtain a single-pilot type rating through an FAA Exemption 4050 that allows for the single pilot operation.

*Table 1 – Business Jets that Can Be Flown Single Pilot and Deliveries through 2008 Year End..*

14 CFR Part 23 (CS 23)			14 CFR Part 25 (Single Pilot Certified)		
Name	TC Date	No. Del.	Name	TC Date	No. Del.
Cessna 510 Mustang	2006	147	Cessna 501	1977	*
Cessna 525 CJ/CJ1	1992	641	Cessna 551	1978	*
Cessna 525A CJ2	2000	378	<b>14 CFR Part 25 (Single Pilot Exemption)</b>		
Cessna 525B CJ3	2004	295	Cessna 550 Bravo	1978	1,020
Eclipse 500	2006	260	Cessna 560 Citation V	1988	341
Embraer Phenom 100	2008	2	Cessna 560 Citation Ultra	1988	172
HBC 390 Premier I/IA	2001	234	Cessna 560 Citation Encore	2000	185
Total Part 23 (CS 23)		1,957	Total Part 25 (CS 25)		1,718

\* Some of the Cessna 500 and 550s are certified single pilot, but the exact figure is not known.

2.4 As of the end of 2008, over 3,600 business jets have been delivered that are authorized to be put into single-pilot operations including the 1,900 of these business jet being type certificated under 14 CFR Part 23 (CS 23.)

## 3.0 Customer and Pilot Demographics

3.1 There is a perception that the lower price point of the very light jet product market segment will result in a less experienced pilot than past business jet operators. GAMA has reviewed pilot demographics data and the following is an overview of the available information about the customers and pilots that fly airplanes within the “very light jet” product segment.

3.2 Customer Data. Customer demographics of the Cessna Mustang were made public at the FAA’s Forecast Conference in March 2007 in Washington, DC.

3.2.1 Nearly two out of three of the Mustang customers have more than 2,000 hours of flight time with most have over 1,000 hours of flight time. Two out of three of the pilots also have multi-engine time and nearly four-out-of-five have turbine experience. Interestingly, 93 percent of the

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customers have previously owned an airplane themselves with half having owned a multi-engine turboprop and one third having owned a single-engine turboprop previously. Thirty percent of the customers have previously owned and operated their own business jet airplane.

3.2.3 Before taking ownership of their Mustang, two-thirds of the pilots owned a turbine airplane.

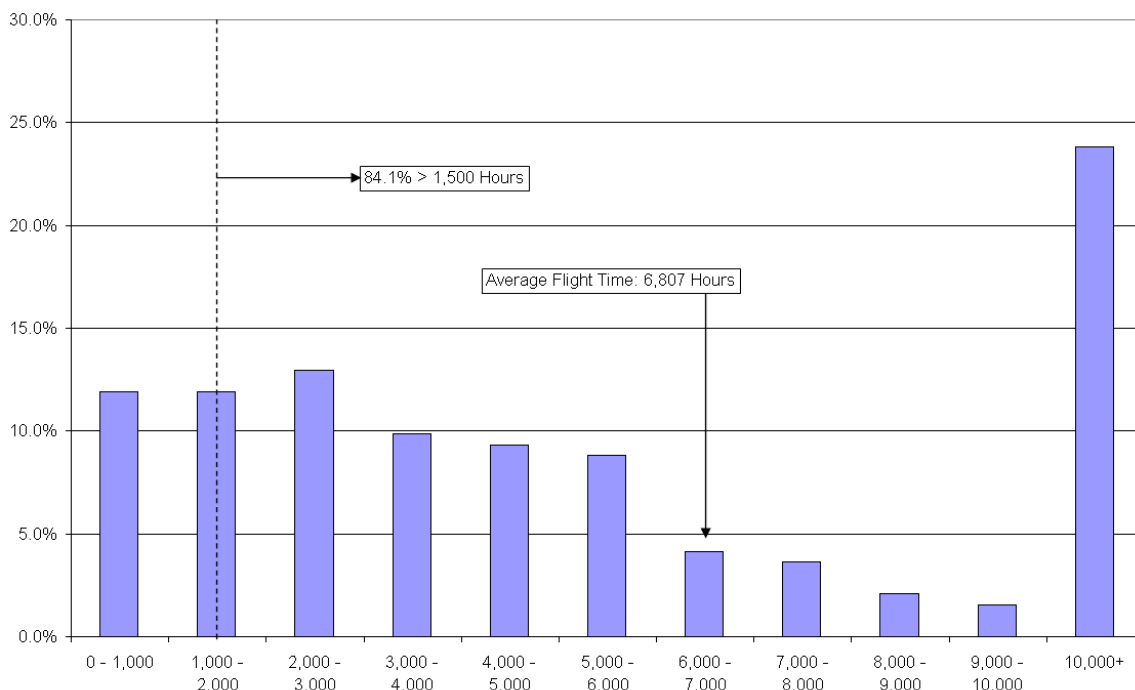
3.2.4 Cessna Aircraft Company expects the Mustang to be used like the CitationJet family where three-out-of-four owners expect to fly the airplane between 100 and 300 hours per year and most only purchasing one airplane.

3.2.5 The Mustang customers indicated in 93 percent of the cases that they are planning on flying the airplane themselves and 84 percent are planning on operating the Mustang single pilot.

3.3 Pilot Demographics in 2007. GAMA has worked jointly with our members and the FAA to collect *de-identified* data about the pilots obtaining type ratings in very light jets. During 2007, type rating training was conducted for two airplanes: the Cessna 510 Mustang and the Eclipse 500 for customer deliveries worldwide. GAMA reviewed de-identified data for 193 pilots who were type rated during 2007.

3.3.1 A common measure of pilot experience is the pilot's total flight time. The average flight time of pilots who obtained a type rating in 2007 was 6,807 hours and the median 4,103 hours. The range of the pilots' flight time is show in figure 2.

*Figure 2 – Overview of Pilot Total Time When Obtaining Type Rating in 2007.*



3.3.2 The data also shows that 84.1 percent of the pilots have over 1,500 hours of total flight time at the time they obtained their type rating.

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3.3.3 The de-identified data also included information about “glass cockpit” experience. According to the data obtained 78.2 percent of the pilot had experience flying glass cockpit equipped airplanes prior to the start of training for their type rating. This experience was either obtained in a transport category airplane or in a piston powered aircraft that uses similar technology.

3.3.4 The de-identified data also included information about the “highest” certificate obtained by the pilot prior to starting their type rating training.

3.3.4.1 Based on a review of the data, in 2007, 57.9 percent of the applicants held an Air Transport Pilot (ATP / ATPL) certificate, 29.0 percent held a commercial pilot certificate, and 13.1 percent a private certificate. More recent data gathered by the FAA through the airmen certification data collection process, specifically for the United States pilot population, indicates a higher rate of ATPs among the type rating applicants at a rate of 84 percent of applicants holding an ATP, 11 percent of applicants holding a commercial pilot certificate, and 5 percent of applicants holding a private certificate. GAMA will work with our members and the FAA to obtain a better overview of the certificates held by type rating applicants.

### **4.0 Pilot Training, Testing, and Checking for On-Demand 135 Operators**

4.1 Pilots who will be operating very light jets in per-seat, on-demand 135 / commercial EU OPS-1 operations (commonly referred to as “air taxi”) or traditional on-demand operations (i.e. charter) will be subject to all the initial and recurrent training requirements prescribed by 14 CFR Part 135 / EU OPS 1 as well as initial checking and continuing line check requirements.

4.2 The requirements for an on-demand operator with respect to training curriculum approval are specified by the regulatory requirements in 135.337, 135.338, 135.339, and 135.340 specifically and the equivalent requirements in Europe.

4.3 In addition to the basic requirements of the regulations, as an on-demand 135 operator, the pilot will also be subject to the company’s continued active oversight by the FAA or its respective National Aviation Authority.

4.4 It is the consensus that the safety system applied to commercial operations is sufficient and properly tailored to accommodate operations by pilots within the very light jet product segment.

## **5.0 Pilot Training, Testing, and Checking for Private Operators**

5.1 The *perceived system change* that has occurred as a result of the development of the very light jet product market segment is seen to be related to three issues:

5.1.1 *Perceived Change: Emergence of small 14 CFR Part 23 / CS 23 type certificated business jets.*

5.1.1.1 Data Shows: This is not something new. The general aviation industry has delivered over 1,900 business jets since 1992 that were type certificated according to the Part 23 / CS 23 small airplane certification requirements.

5.1.2 *Perceived Change: Emergence of single pilot business jet operations.*

5.1.2.1 Data Shows: This is not something new. Single pilot business jet operations have been conducted in the general aviation industry and manufacturers have designed, certified, and placed into operation over 3,600 single pilot capable business jets since the 1970s.

5.1.3 *Perceived Change: Less experienced pilots are flying business jets as a result of the lower price point.*

5.1.3.1 Data Shows: So far, the data seems to indicate that the pilots that are purchasing these business jets have experience levels of several thousand hours and in most cases turbine airplane experience.

## **6.0 Existing Training Programs for Private Operators**

6.1.1 While the data does not necessarily point to a revolution in the type of customer or owner that the business jet industry is seeing – rather an evolution – the manufacturers and training providers have worked pro-actively unilaterally, across industry, and with the regulators to ensure that the pilots of airplanes within the very light jet product market segment are provided with the most advanced approach to training in general aviation. This includes adopting the guidelines developed by the National Business Aviation Association (NBAA)<sup>1</sup> in the development of the model-specific training programs.

6.1.2 The manufacturer community has adopted the NBAA VLJ Training Guidelines when developing their model-specific training programs. The NBAA Guidelines which discuss necessary curriculum and criteria were developed with broad input from the FAA, the manufacturers, insurance providers, and training providers.

6.1.3 The NBAA Guidelines “reflects a compilation of identified areas of risk areas associated with transitioning into VLJs and how best to mitigate these risks with an appropriate training curriculum.” GAMA is very supportive of this safety risk management approach that the NBAA Safety Committee employed during the development of the Guidelines.

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<sup>1</sup> NBAA Training Guidelines for Single Pilot Operations of Very Light Jets and Technically Advanced Aircraft published in January 2005.

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6.1.4 The manufacturers have developed training programs focused around four components that are based on the NBAA Guidelines:

- 1) Pre-qualification evaluation and testing
- 2) Type rating training
- 3) Supervised Operating Experience (SOE also referred to as IOE or “mentoring”)
- 4) Recurrent training

6.1.5 These four components are common for all GAMA member companies and the programs that have been put in place by the manufacturers and their contracted training providers. The following table provides an overview of how the community has implemented the NBAA Guidelines.

*Table 3 – Overview of GAMA Training Component with Reference to NBAA Guidelines*

<b>GAMA Manufacturer Training Component</b>	<b>NBAA Guidelines Description</b>
1) Pre-qualification Evaluation and Testing	3.1 Initial Candidate Evaluation 3.2 Pre-Training Study Package 3.2.1 Cockpit Resource Management / Single Pilot Resource Management
2) Type Rating Training	3.3 Manufacturer’s Training
3) Supervised Operating Experience (SOE)	3.4 Post Rating Training 3.5 Initial Operating Experience 3.5.1 Mentor Program
4) Recurrent Training	3.6 Annual Recurrent Training

### 6.2 Pre-qualification Evaluation and Testing

6.2.1 Pre-qualification programs have been put in place by each manufacturer and their training program provider. The pre-qualification programs employ a combination of a pilot questionnaire, which includes an overview of the pilot’s demographics, and a flight skills assessment (reference NBAA 3.1) with the common goal of ensuring that the pilot can properly fly in accordance with the Practical Test Standards (PTS) and pass an Instrument Proficiency Check (IPC). Successfully passing an IPC has been identified as a criterion by which pilots can successfully be evaluated as to their ability to complete the type rating training program. This is supported by FAA test data which points to instrument flying skills being the most common failure area during the type rating test.

6.2.2 The manufacturers and their training providers have put in place supplemental training programs to accommodate those pilots that do not perform well during the pre-qualification evaluation and testing. These programs range from providing additional flight training including turbine transition courses to pairing the pilot with a recommended type rating curriculum.

6.2.3 FlightSafety International (FSI) provides training for the Cessna 510 Mustang and recommends a type rating curriculum, which is based on the pilot’s score in a Cessna developed Proficiency Index pairs the pilot with a single pilot authorization, crew, or second-in-command

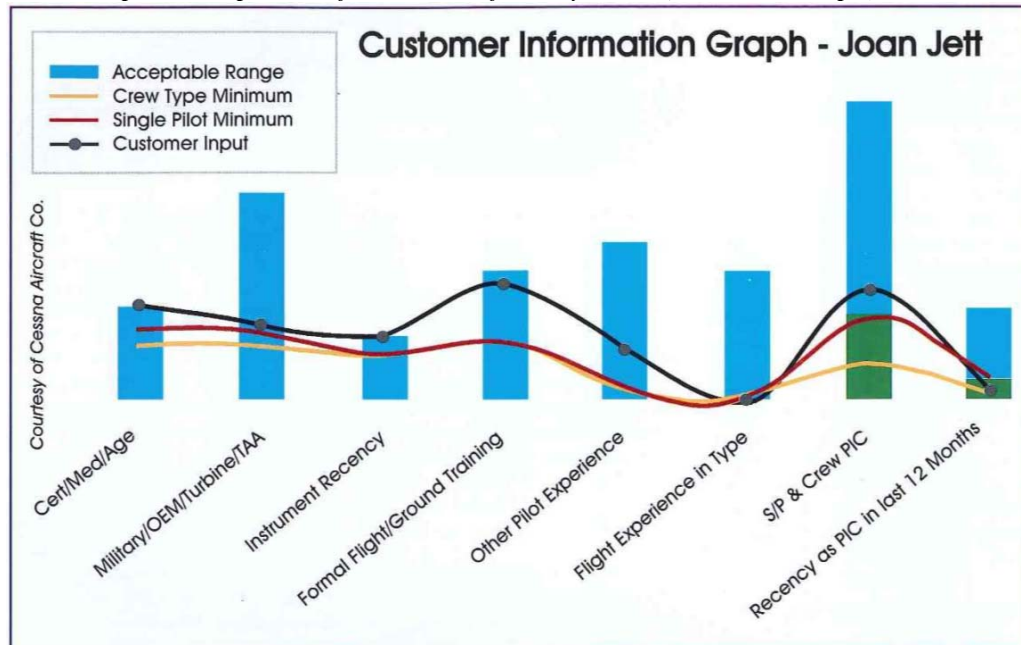
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type rating. The Cessna Proficiency Index includes factors such as the certificates, medical and age of the pilot; the type of time the pilot has accumulated; the pilot's instrument recency; the pilot's formal flight/ground training; flight experience in type; single pilot & crew Pilot-in-Command (PIC) time; and recency as PIC in past 12 months. Other OEMs and training providers employ similar pre-qualifications.

6.2.4 Based on the score obtained by in the pre-qualification testing the pilot is either put directly into the type rating course or provided an opportunity for additional flight training before starting training.

Figure 3 – Graphical Depiction of Cessna Proficiency Index (Bart Int'l Graph)



### 6.3 Type Rating Training (U.S. FAA Description)

6.3.1 Type rating training is a requirement for all pilots that will fly a business jet or any turbojet airplane based on 14 CFR 61.31(a)(2) in order to operate the aircraft within the very light jet product segment.

6.3.2 The type rating check involves a performance based test where the applicant undergoes a proficiency based skills test in accordance with FAA-S-8081-5E which is the Air Transport Pilot (ATP) Practical Test Standard (PTS).

6.3.3 Cessna Aircraft Company currently provides five options for the owner pilot based on their performance during the pre-qualification phase of the program as to the type rating that they are recommended to pursue (see 6.2.4.) These five levels are:

Table 4 – Cessna 510 Mustang Type Rating Options

- Single pilot type rating
- Crew or Single Pilot with Skills Assessment
- Crew type rating



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- Second-in-Command or Crew with Skills Assessment
- Second-in-Command type rating

6.3.4 The typical type rating course includes the following (NBAA 3.3) training:

- Pre-training study package review and testing
- Aircraft systems
- Autoflight skills
- Avionics and navigation
- Maneuvers and profiles
- Emergency and abnormal procedures
- Limitations and specifications
- MEL, placards and maintenance requirements
- Aircraft servicing

6.3.5 Specific emphasis is also placed on single-pilot resource management (SRM), automation management, risk management fundamentals, and application of standard operating procedures (SOP).

6.3.6 All training providers are employing Level D simulators or Flight Training Devices as part of their training curriculum. The manufacturers have each identified exclusive training providers which are:

*Table 5 – Manufacturer and Training Providers*

Manufacturer	Training Provider
Cessna Aircraft Company	FlightSafety International
Eclipse Aviation Corporation	High Power Aviation
Embraer	CAE

Diamond Aircraft and Cirrus Design Corporation have not made public statement about their training provider yet.

#### 6.4 Supervised Operating Experience

6.4.1 Supervised Operating Experience (SOE) is also referred to as Initial Operating Experience (IOU), Line Oriented Flight Training (LOFT), and “mentoring” depending on the company and training provider. Supervised operating experience and similar pilot time building programs have been provided for a number of upgrade programs in the general aviation industry in the past.

6.4.2 Turbine airplane SOE-like training programs already in place include the Piper Aircraft Company’s PA-46 Meridian LOFT program offered through SimCom and Cessna Aircraft Company’s experience building program for the Citation CJ-series of aircraft.

6.4.3 For piston engine powered airplanes, supervised operations have long been employed to allow less experienced pilots or pilots lacking experience in the specific make and model to gain experience in a controlled environment including the Cirrus Access<sup>TM</sup> program.

6.4.4 These programs have all had one thing in common: *the development of a less experienced pilot into one that meets the performance and experience requirements including those for insurance underwriters.*

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6.4.5 Companies employ different approaches to the supervised operating experience. One company's philosophical approach is the integration of the SOE into the pilots day-to-day flying to ensure real-life flight scenarios. Another company provides for a structured SOE training curriculum that covers 25-hours and specific event based training for the pilot which is separate from their regular training.

6.4.6 The basic SOE course offered by companies involve 25 hours of flying, which aligns with the regulatory requirement of 14 CFR 61.63 for pilots who have obtained their type rating in a simulator, but the companies also offer add-on SOE work for pilots that elect or are deemed to be well suited for additional supervised flying.

6.4.7 The NBAA Guidelines provide for a set of Categories (1 through 4) based on the pilot's past experience. This, however, would be modified based on the individual pilot's specific skill set and performance during pre-qualification and type rating training.

*Table 6 – NBAA Guidelines for SOE Programs based on Typical Pilot Experience*

Category 1	Category 2	Category 3	Category 4
Pilots transitioning from left seat of previous jet aircraft	Pilots transitioning from turboprop or cabin-class twin left seat	Pilots transitioning from single-engine turboprop or pressurized single-engine aircraft	Pilots transitioning from single-engine aircraft (recip) or as determined by insurance company
25 hours operating experience	35 hours operating experience	50 hours operating experience	100 hours operating experience
Minimum of 5 cycles	Minimum of 8 cycles	Minimum of 10 cycles	Minimum of 25 cycles

### 6.5 Recurrent Training and Testing

6.5.1 Pilots and owners of other similar sized and operated aircraft actively participate in recurrent training programs on an annual or semi-annual basis. In order to obtain and maintain insurance all operators of business jets go through annual recurrent training.

6.5.2 GAMA is strongly supportive of the FAA's draft proposal that mandates annual recurrent checking for all pilots who operate single pilot turbine airplanes through an expansion of 14 CFR 61.58 requirements. In addition to the checking, GAMA members are encouraging owners to go through type specific training on an annual basis.

## **7.0 Conclusion and Path Forward**

### 7.1 Standardization of Training

7.1.1 There is great concern in the general aviation community about attempts to standardize the training programs that are employed for “very light jet pilots” or other single pilot operations since this may stifle training innovation and standardize around the lowest common denominator.

7.1.2 The training programs allow for product and market differentiation that accommodates different models, size airplanes, and avionics configurations.

7.1.3 The training program providers continue to be responsive and evolve the training programs based on what industry learns more about how training is best conducted.

7.1.4 *Standardization of the curricula or the approach to training would have a negative impact on safety by limiting the training provider’s ability to target the skill sets needed for specific products and pilots.*

### 7.2 Path Forward

7.2.1 There are opportunities to focus industry and government resources in the following three areas in order of priority:

7.2.1.1 Continue to actively collect data and monitor the training and operation of airplanes within the Part 23 / CS 23 turbine airplane product segment including comparison of the operation of these airplanes with airplanes that have similar performance.

7.2.1.2 Revisit the NBAA Training Guidelines based on lessons learned in actual flight training and operation of this emerging product segment. (This is currently being in cooperation between manufacturers and operators under the NBAA Safety Committee.)

7.2.1.3 Review examiner standardization for administering practical tests in very light jets

7.2.2 Going forward, GAMA is working jointly with the FAA and operator groups to collect data and monitor the training and operation of this new product segment of the general aviation industry. Based on what is learned from the data and the analysis of the data, industry will work to make targeted changes to and recommendations about training and operation of these airplanes.

## **8.0 Reference Documents**

NBAA Training Guidelines for Single Pilot Operations of Very Light Jets and Technically Advanced Aircraft published in January 2005 available at [www.nbaa.org](http://www.nbaa.org).