



VERY LIGHT JETS : : DATELINE 2010

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As the initial wave of very light jets proceeds toward certification and customer deliveries, legitimate questions are being asked about the potential impact on aviation safety and operations. What we also should be discussing is the promise that these efficient little aircraft hold, and how they can be safely and productively integrated into a professional flight department.

Today, Monday, April 23rd, 2010 is a special day. I'm Manager of Aviation Services for a Fortune 1000 company, and today I will be the captain on our company's first Very Light Jet (VLJ) passenger trip.

Our company and our department have been through a long and deliberate effort to get to this point. As a result, we expect our flight department's services and success to be dramatically affected by this small, efficient aircraft. We will get our first feedback today.

Our lead passenger is our company's CFO, Jim. Historically, he has not been a big supporter or user of our aviation services. In fact, he has often said our other two jets, a Gulfstream and a Hawker, are expensive extravagancies. We'll see what he thinks of the VLJ by the end of the day.

We did not arrive at the decision to get this VLJ easily. In fact, among our flight department members there was a lot of strong discussion and concern about the VLJ lowering our standards" and raising safety and service risks. In the end the need to improve and expand the support of our company's travel needs caused us to try this extraordinary little aircraft. There is no better alternative for our passengers.

We appear to be in good company. Some forecasters place the VLJ market at roughly equal to the entire current fleet of traditional business jets—6,000 plus aircraft. Based on what we have learned, I believe the need will be even greater. It is the right tool, for the right price, for our job. And if we can use it, so will tens of thousands of others like us.

When we began our investigation of VLJs we reviewed the history of their development. We confirmed that the push to fill the need for a low-cost jet came from entrepreneurs. These visionaries were frustrated by the glacial speed of traditional OEM product evolution. The shapers of aviation's future included people like Dr. Sam Williams (Williams engines), Vern Rayburn (Eclipse airframe), Dan Schwinn (Avidyne avionics), and Alan and Dale Klapmeir (Cirrus Design's mass-produced composite aircraft). Their far-sighted ideas, and leading-edge technologies and processes came together to make the VLJ dream a practicality.



But, for some people the VLJ held the specter of future failures. The two fears we heard most often about VLJs were about their safety and the pressure that a multitude of little jets would put on the existing infrastructure. But where others saw threats, our department saw promise.

SAFETY ISSUES

Our department's first and foremost deliverable is safety. We know the business aviation accident rate is equivalent to that of the major domestic airlines. But will a flood of very small jets raise the risks? Will those risks lead to enough VLJ accidents that our passengers will be concerned? Not if we, and the rest of the business aviation community, are proactive.

The safety of the VLJ airframe and its systems is assured through the FAA certification processes. In fact, most of the aerodynamic designs for this new generation of jets have phenomenally forgiving flight characteristics and approach speeds. It doesn't take a "Real Man" to fly these deliberately designed-to-be-docile aircraft. That's a far cry from the compromises between flight handling characteristics and performance we put up with in aircraft like the early Learjets and MU2s.

SMART SYSTEMS

Beyond docile flight characteristics, the designers of the VLJs integrated safety into their aircraft's systems, too. They aggressively sought ways to reduce pilot workload and improve the information available for situational awareness and critical decision-making. A few of our VLJ's avionics and smart systems innovations include:

- Dual Primary Flight Displays
- Dual Multi-Function Displays
- Reversionary display capabilities
- Integrated electronic flight bag
- Highway in the Sky flight path guidance
- The equivalents of Enhanced Ground Proximity Warning System and TCAS II
- Real-time weather data and display uplink
- Lightning strike information, and
- Computerized trend monitoring and aircraft system fault tracking and troubleshooting.

The additional price for these capabilities in our Hawker was more than a half-million dollars. The cost of these same capabilities in our VLJ was a fraction of that price. Today the leading-edge avionics and systems technology are not just in a Falcon Jet or a Gulfstream. They are in VLJs, too.

The safety innovations in the VLJ don't stop with the avionics. The VLJs are light enough to perform very well with one highly efficient engine. But even with the excellent reliability of these powerplants, we required systems redundancy. There are



a number of solutions for backup electric power among the single-engine VLJs. But we didn't want to deal with the downside risk of what would happen if the one and only pusher pooped out.

Yes, a couple of the VLJ manufacturers have incorporated the whole airframe parachute system that is similar to the one pioneered by Cirrus and BRS (Ballistic Recovery System) in the SR-series of aircraft. The ability to support the weight of a VLJ at higher deployment speeds has been proven. But the members of our department really love the idea of two or more engines. This led us to selecting a VLJ with the 3X Jet Power system.

ONE ENGINE OR TWO

The 3X Jet Power system is a patented application of existing, proven technology. It is so logical you wonder why you didn't think of it yourself. Mounted in the base of our VLJ's vertical stabilizer is an engine powerful enough to provide the thrust equal to a twin-engine jet. A second engine, half its power, is mounted below it in our VLJ's tail cone. The smaller engine produces enough thrust to meet the requirements for FAR Part 25 single-engine operations in the case of an engine failure during departure.

The engines' systems are separate and redundant. Their compressor sections are shielded to contain fragments, in the unlikely case of a de-contained rotor burst. In other words, it is a typical twin jet except for the configuration (one on the tail and one in the empennage). Our aircraft is even easier to control than other twin-engine layouts because all thrust is aligned with the aircraft centerline.

Our engine management operating policy is to start the smaller #2 engine and use it for extended taxi requirements. We start the large #1 engine in plenty of time to prepare for takeoff. The extra thrust available from the 3X Jet Power system makes the climb to cruise altitude quite impressive. But when we level off, 3X Jet Power gives us a unique option.

Normally we use both engines in all flight phases on passenger legs and whenever we are in a bit of hurry. Our cruise speed is about 400 knots. Surprisingly, the aerodynamic and operational efficiencies of the 3X Jet Power system exceed those of traditional twin-jet engine installations. Two engine cruise yields Director Operating Cost (DOC) savings that are 8-10 percent better than traditional twin-jet engine installations.

One of the things we expect in our VLJ operations is a higher rate of aircraft relocation because of its mission profile. That's where the unique option comes into play and why we selected an aircraft with 3X Power. During cruise flight on our ferry legs we can shut down the smaller number #2 engine. The engine's intakes stow into the fuselage to reduce drag. Our VLJ's single-engine cruise speed is about 350 knots, a 12.5 percent reduction. At the same time we save between 35-40 percent on DOC.



The computerized engine management and monitoring system will warn us if we try to take off on only one engine or when an engine begins an uncommanded spool down. It has even been programmed to automatically restart the #2 engine if the #1 engine malfunctions. Engine #2 in-flight start time, with the ram air effect, is less than 10 seconds. In other words, 3X Jet Power gives us the best of all worlds: multi-engine redundancy, improved twin-engine efficiency, and the option to gain substantial added single-engine efficiency during cruise.

OUT OF CONTROL

But even with all these safety elements designed into our VLJ, our department was still concerned about assuring both the reality and image of safety as it is perceived by our company and its passengers. To put it bluntly, our passengers' image of our VLJ's safety could be out of our control. It may be in the hands of other VLJ pilots. Our response has been two-pronged. We deliberately established a safety information campaign to keep our passengers in the know about VLJ safety. We also established a proactive set of VLJ policies and procedures that address our greatest safety risks.

On the information side, we explained to our passengers that over the decades the overall accident rate has declined with the advent of new technologies and better in flight information. While the accident rate has declined, the proportion caused by crew error has remained nearly constant at about 70%.

On the policies and procedures side, we also explained that inexperienced pilots, whether new to the air or new to their aircraft, incur the greatest risks. Our department implemented multiple initiatives to address this nasty fact. The VLJ airframe and avionics manufacturers have banded together to assure the quantity and quality of VLJ initial training. Even so, just as we have with the Gulfstream and the Hawker, we have created our own syllabus and supplemental training requirements. In doing this we relied heavily on the NBAA Safety Committee's excellent guideline for VLJ training and operations (see "VLJs: Training for the 21st Century," page XX this issue; also, <http://web.nbaa.org/public/ops/safety/vlj/>). In other words, there is no degradation of standards and practices, no matter which of our aircraft our passengers use.

But we aren't the only ones pushing the VLJ safety bar even higher. The insurance community has exercised some control by dictating specific flight experience and training requirements for all VLJ drivers. But let's face it, VLJs being operated by two highly trained and experienced professional pilots will, in all likelihood, have a safety record that will parallel that of the rest of the business aviation jet fleet. And the business operators who choose to operate their VLJs single-pilot are apt to have a higher accident rate, like those who choose to operate turboprops using a one-pilot crew.



RUSHED DECISIONS, BAD RESULTS

But we are most worried by the record of VLJs being operated by nonprofessional pilots. They will undoubtedly have the highest accident rate. Hopefully, the efforts of the NBAA and the OEMs are having a positive impact on reducing the raised risks in this segment.

One major challenge is taking an inexperienced pilot out of a Baron or Cirrus and placing them in an aircraft moving at more than twice the speed they are used to. If they aren't ready for the higher speeds of a VLJ their decisions will be rushed, leading to bad results.

We recognized this speed differential as a potential issue with our new-hires. Our answer has been to change the way our crews think about distances. We have shifted our focus on distances from one of "miles to go" to one of "minutes to go." We now use the clock as the primary measure of progress in flight. It seems to have made the adjustment to flying our aircraft a non-event.

An unexpected benefit we are gaining from adding the VLJ to the fleet is improved succession planning. We knew we had a number of Baby Boomers coming up on retirement, and we weren't too excited about dumping new young aviators into our Hawker or Gulfstream. But the VLJ has given us an entry-level platform that allows us to grow and develop our future captains... our way.

You can see we have taken great care to be certain that our VLJ operations are every bit as safe as those of our larger aircraft. But we are also worried about our passengers' perception of VLJ safety. That is why we are supporting an initiative to further refine and redefine the FAA's and NTSB's safety data and statistics. Our industry has been fighting misguided metrics much too long. Bob Breiling has toiled for years trying to offset the bundling of general aviation accident data. His has been a dedicated effort to describe accurately our industry's safety record.

But Bob's efforts are not enough. It is time to make a dramatic shift in measuring safety data. We believe the FAA, NTSB, and insurers need to more closely define the profession of the crew involved in an aircraft event. Was the crew made up of professional pilots or not?

The Citation 500/501 aircraft are an example of the problem this improved measurement addresses. The low capital cost of these older light jets is very attractive to owner-pilots. But there are still a number of these aircraft flown for corporations, too. The collective accident rate for Citation 500/501s is about four times that of the rest of the Citation fleet. Since the remainder of the Citation fleet is predominately flown by professionals, my assumption is that the 500/501 accident rate is strongly influenced by a large owner-flown population. You can see why the owners of VLJs whose aircraft are operated by professional crews don't want their insurance premiums, or their passengers' perception of safety, affected by the higher risk owner-flown segment.



SERVICE ISSUES

The VLJ operates in the business aviation sweet spot. Airline planes, trains, and automobiles do a terrible job of providing our passengers with reliable and efficient door-to-door service over the regional distances of 150 to 750 or so miles. The VLJ is the first aircraft to meet our passengers' needs for a better solution. And it does it without many of the problems that early VLJ detractors predicted.

Our VLJ is designed to operate in the emptiest of altitudes; flight levels 180 to 300. This is high enough to clear most weather, but low enough to avoid most traffic. Even so, the FAA is already exploring the expansion of the RVMS envelop to accommodate even greater mid-level traffic flows. The FAA is also pushing the development of interactive altitude and position tracking systems that will allow aircraft to use direct routing and proactive traffic conflict management. The hardware already exists. It is a matter of developing the protocols and software to make it work.

In addition, the incorporation of precision GPS approaches has opened up a lot of airports for IFR use whose runways are quite capable of handling VLJ traffic but not their asphalt-hungry brethren. Even short parallel or diagonal runways at major airports are being used to improve traffic flow for VLJs.

Yes, we expect to experience peak-period demand slowdowns and traffic delays. But the controllers are quickly learning how to work with these agile little aircraft. I can understand this because I flew light aircraft off of Atlanta's Hartsfield for six years. Once the approach and tower controllers learned the capabilities of my aircraft I saw very few delays. They seemed to take pride in wedging me in-between airline arrivals or departures. I expect very similar support for our VLJ.

The other area of service concern we face is uncertainty about this new aircraft's reliability, maintainability, and supportability. We are reassured by some interesting innovations in the design and manufacture of our VLJ. The primary aircraft systems (engines, avionics, etc.) are designed to be plug and play. They permit the quick exchange of components. The onboard systems condition tracking software does most of the troubleshooting. We simply download the anomaly data and the OEM lets us know the corrective action. For the bigger problems, we are covered by a tip-to-tail support program that is integrated into regional depots. We can have the replacement unit in our hands in a matter of hours. Accordingly, we have every reason to expect our VLJ will be reliable and easy to maintain.

THE PRICE IS THE BEST PART

I recently sat down with Jim, our CFO, to ask him why, after years of reticence to support our aviation services, he had actually endorsed the acquisition of the VLJ. He said that, to his knowledge, it is the first twin-jet aircraft to carry two or more passengers for about the same cost as a pair of airline tickets. Jim said he appreciates the strategic value of our larger jets. But he has not felt comfortable using the larger



aircraft when his role in the company is to champion cost savings. He hopes today's trip proves him right. He wants to know what our actual costs are at the end of the day.

I told him we are already seeing some pretty dramatic savings as a result of our VLJ's design and technology. For instance, the cost of the avionics suite we have in the Hawker we bought last year was much lower than we would have traditionally expected because companies like Avidyne and Garmin have become major players in the business aircraft arena. Collins and Honeywell have had to respond aggressively in order to remain competitive.

On another front, there has been a strong upward flow of other systems and maintenance technologies into larger aircraft that are dramatically improving their costs and performance, too.

Jim confided that he'd done some research on airline travel. He said the costs of airline travel have gotten worse over the past handful of years. He found that the time cost of airline travel door-to-door is about three hours per leg greater than it is on a business aircraft. Within a radius of about 500 miles, that airline leg is apt to be in a regional jet (RJ). Over half of Delta's departures are now regional aircraft. These 50-100 passenger tubes are less expensive for them to operate on shorter segments. But, the RJs are less convenient and less comfortable for our company's passengers, too.

The airlines have cycle costs that make short legs much more expensive per mile. Coach tickets for regional airline legs are often in the \$0.75 to \$1.00 per passenger mile range. In other words, The Direct Operating Cost (DOC) of our VLJ, at about \$1.50 per mile, is similar to the cash cost of airline travel for one or two passengers. The airlines finally have a strong business aviation competitor.

AT THE END OF THE DAY

It is now 6:00 PM. Jim's trip went very well. He and the head of purchasing met with the executives of two of our company's major suppliers in two separate cities. Our passengers were home in time for dinner. Our DOC for this trip worked out to be about \$1.43 per mile, including fuel and maintenance reserves. When I shared this calculation with Jim, he told me that was "only a five percent premium" over the airline ticket quote he'd gotten from corporate travel. He also added that the airline trip would have required an overnight stay plus another half-day of travel so, by his estimation, the costs were better than a push.

But Jim's final confession was the best. He said he'd been putting off the visit he took today because airline travel is such a hassle and the outcome of the meetings was uncertain. But the results of the trip were even better than he'd hoped. In the end, he says they gained some very important commitments from our suppliers that, in Jim's words, will save us much more than the cost of our VLJ.



As he headed for his car he asked our scheduler to let his assistant know the availability of the Hawker for a trip to Denver for three passengers plus himself. I guess we'll have to add one more point of value for our VLJ: business aviation sales tool.

Author's note: This story is fiction. As mentioned in the opening, the events described take place five years from now. But many of the story's premises are today's emerging realities. The advances I described about BRS, 3X Jet Power, avionics and systems developments, and ATC changes are all in the works or under consideration.

The potential market for VLJs has likely been underestimated by most observers. I know of two companies that intend to own and operate a combined fleet of at least 60 of these aircraft. The VLJ will be especially valuable to business aviation because it lowers the barriers to entry for thousands of potential users, like the fictitious Jim. I trust the VLJ segment will also attract a new generation of business aviation professionals to our industry. And that's a good thing because there are a lot of us grey hairs who will leave the hangar for the last time by 2010 or shortly thereafter. Business aviation needs new blood as much as we need the VLJ. They may arrive hand-in-hand.