

Very Light Jets Impacts on NAS Operations

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“Without the unique benefits of air transportation, our quality of life would be dramatically reduced. Whether those benefits will continue to be available in the future will depend on actions we begin taking now. The system is already showing signs of stress and it is clear that projected demand will soon surpass the system’s capacity.”¹

“Now imagine an alternative world where a traveler or shipper determines the departure and arrival times – instead of being confined to a predetermined schedule... Think of the possibilities if owning a recreational plane, a micro-jet, or a share of a jet capable of flying in nearly all weather conditions were affordable to more Americans.”²

In the Next Generation Air Transportation System Integrated Plan, published in December 2004 by the Joint Planning & Development Office, JPDO projects a range of outcomes by year 2025 that can include increases in demand to a level of up to 3X times the number of operations in today’s current National Airspace System (NAS).

The vital work of the FAA and JPDO in transforming the NAS from its current 1950’s technology to a modern information-centric, network-enabled system of systems is finally gaining traction inside the Beltway. Nevertheless, the sheer magnitude of the systems-of-systems planning, funding, and engineering required, as well as the

accompanying political and social issues, continue to stall NAS modernization. If this delay continues, the result could be monumental air traffic gridlock, with unimaginable economic and social consequences. No one can predict when this could occur, in some measure because the timeline can be affected by several disruptive technologies.

Some of these technologies will likely have minimal effects on the NAS in the near to mid-term. The integration of unmanned or remotely operated aircraft into the NAS does not seem likely in the near to mid term. The NASA Small Aircraft Transportation System (SATS) concept, which suggests that someday individuals with little or no aviation skills may be operating private air vehicles controlled and separated from each other by computer systems, seems even more remote.

In contrast to these more remote technologies, however, there is a third very real, disruptive technology approaching in the very near term – the Very Light Jet (VLJ). Next year, with virtual certainty, these small, moderately priced, six-passenger twin-engine jets will be certified and will begin to populate the NAS in increasing numbers, enabling personal and on-demand, point-to-point air service to most of the Nation’s approximately 5,400 airports.

What Industry & Government Are Saying About the VLJ

The pending introduction of the VLJ has raised some concerns. Airline operators see a possibility that the skies and airports they use will suddenly be filled with large numbers of smaller and slower aircraft. Increased airport and airway congestion could mean more delays and higher operating costs for an industry that is already hanging by a thread.

At the same time, the FAA, NASA, and the JPDO have expressed similar concerns regarding the potential impact of VLJs on the NAS Air Traffic Control system:

- “The FAA predicted this spring that 4,500 microjets will be flying by 2016.”³ To put this in perspective, according to the Boeing 2005 Current Market Outlook, the 2004 year-end global fleet of commercial aircraft consisted of just 16,778 aircraft, and by 2025 that fleet is expected to more than double to 35,287.⁴
- “An FAA computer simulation last year predicted that flight delays would climb more than 300% by 2010 if microjets {VLJs} arrived as expected and the Agency made no improvements, said its author, FAA mathematician Doug Baart.”⁵
- “NASA says the number {of VLJs} could be even higher. It estimates the market at more than 8,000 by 2010.”⁶
- The JPDO Next Generation Air Traffic System Integrated Plan states that “a shift of 2% of today’s commercial passengers to micro-jets that seat 4-6 passengers would result in triple the number of flights in

order to carry the same number of passengers as today.”⁷

These rather stark projections raise two important questions. First, can VLJ aircraft be assimilated seamlessly into today’s NAS? And second, would a rapid growth in VLJ deliveries in the mid- to long term overwhelm the air traffic control system and create widespread gridlock, long before any Next Generation Air Traffic System (NGATS) could be implemented? Are these concerns justified? Let’s take a look at the issues.

The Very Light Jet & “Disruptive Technology”

Recently, some aviation experts have referred to the VLJ as a “disruptive technology,”⁸ Clayton M. Christensen of Harvard Business School originated the term in his 1997 book The Innovator’s Dilemma. Christensen described “disruptive technology” as “a technology bringing to market a very different value proposition, ...products typically cheaper, simpler, smaller, and frequently, more convenient to use.”⁹ He also said that a disruptive technology can initially appear to be of limited application and minimal consumer appeal, but can ultimately trigger changes (sometimes deadly) to industries that fail to recognize these changes and continue to rely on existing business models and associated “sustaining technology.”

With respect to the airline industry, it can be argued that VLJs will provide business and upscale leisure travelers with a cheaper, simpler, smaller and more convenient point-to-point substitute for traditional hub airline

services. Since airlines rely heavily on revenues from these valuable passengers, substantial skimming of that traffic could have major consequences.

FAA and other air traffic management experts are also concerned about the possible impact of VLJs on the ATC system. If just a small amount of traffic were skimmed to VLJs from commercial carriers, it could mean a significant increase in the number of NAS operations. And if the era of personal air vehicles is indeed coming soon, VLJ-like traffic volume could grow rapidly.

FAA and JPDO are busily trying to develop a Next Generation Air Traffic System based on a timeline intended to meet current projections of traffic. The possibility of early, rapid VLJ growth could mean that aviation gridlock might come a lot earlier than expected. So let's take a look at the VLJ. Will it be a "disruptive technology," and just exactly what will its impact be on the NAS in the near to far term?

The Near-Term Operational Impact of the VLJ

Very Light Jets are a different breed. Serving stage lengths of up to 1,300 nautical miles, they are capable of operating at altitudes of up to 41,000 feet, carrying 4 to 6 passengers rapidly and comfortably above the weather and in airspace customarily used by commercial airlines. Let's examine the possible impact of VLJs, from an operations perspective.

VLJ Aircraft – Safety & Equipage

The Eclipse is a great example of VLJ aircraft design. Designed as an integrated airframe and avionics platform, these aircraft are subjected to rigorous certification standards set by the FAA. And precisely because these aircraft are new, integrated designs, not just rehashes of old airframes with new black box avionics, they are getting even more rigorous attention from FAA. VLJs will clearly be safe upon certification!

As to equipage, most VLJs will include advanced integrated avionics as standard or optional equipment. For example, the Eclipse will be equipped to support:

- ADS-B for precision surveillance monitoring;
- Dual GPS with WAAS for precision navigation;
- Auto-throttles;
- Data link communications capability to connect to tomorrow's network-centric ATM architecture;
- Color Weather Radar;
- Dual FMS (Flight Management Systems) for trajectory-based operations in today's environment and in the NGATS of tomorrow.
- The only option the Eclipse does not yet include is data link to FMS integration linkage.

In short, the typical VLJ will distinguish itself as better equipped than many of the aircraft in today's commercial fleets.

The Pilots – Training and Qualifications

A VLJ pilot will be required to hold an FAA Pilot certificate with type rating, which implies appropriately high levels

of training and experience. In addition, because VLJ manufacturers are particularly sensitive to the need for high-quality training, they are taking training curricula one step further. For example, Eclipse Aviation signed an agreement with the United Services division of United Airlines to provide a mandatory training program similar to that of commercial airline pilots.

There are still a few unanswered questions as to whether VLJs will be certificated to fly with a single pilot crewmember, but current evidence supports such a step for several reasons:

1. Meticulous attention has been given by both industry and FAA to new advanced training standards for high performance aircraft {i.e. FITS – FAA\Industry Training System};
2. The VLJ's integrated aircraft design and advanced avionics platform will help make flight training and flight operations much safer, yet much simpler;
3. Using advanced VLJ avionics capability, pilots can maintain higher levels of situational awareness.

This combination of rigorous training and sophisticated design will place VLJ pilot operating capabilities and operating environments near to, at or even above the sophistication and capability of many airline cockpits.

Air Traffic Operations – Near-to Mid-Term VLJ Impacts

Airport and Terminal Area Operations

There is speculation that even in the near to mid-term VLJ traffic will trigger congestion or gridlock at major hub

airports. They won't, for several reasons.

With few exceptions, VLJs just won't want access to major hub airports. The VLJ business model is based on providing convenient, personal point-to-point services through non-congested airports. VLJ passengers will be time-sensitive and convenience-minded, and they will use VLJs precisely to avoid the hassles associated with large hubs.

Secondly, VLJ aircraft are specifically designed to operate from runways as short as 3,000 feet (including many grass strips). This makes them ideal for providing point-to-point services to most of the 5,000+ U.S. airports serving small to medium sized markets.

Some of those airports lack the runway, taxiway, or terminal facilities to support larger aircraft. Others serve markets for which there is no business case for commercial service. Still others have some commercial service but offer few point-to-point travel options, forcing travelers to connect through congested hub airports. For these communities, the VLJ will provide convenient new service options. This is their market niche. Narrow body jets and RJs just can't serve most of those cities.

Third, of all the reasons why VLJs won't frequent major hub airports, the biggest one is pure economics. Projected passenger cost-per-mile for VLJ travel will be equal to or higher than full commercial coach fares. VLJs will also probably provide no frequent flier benefits. Therefore, business or upscale leisure travelers flying through hub airports will be inclined to choose a traditional airline. VLJ travel at its

currently projected costs will never be a viable economic substitute for commercial travel at major hub airports.

But what if despite all these reasons, VLJ operators decide to operate into hub airports. Will those operations disrupt traffic or induce gridlock? Absolutely not! The effects will be minimal, for the following reasons:

- VLJ pilots will need adequate prior experience and will receive rigorous training, equivalent in many cases to that for commercial pilots;
- VLJ aircraft will have advanced integrated avionics to provide enhanced pilot situational awareness, enable seamless traffic flow integration and optimal spacing with commercial traffic flows;
- VLJs are capable of operating at speeds compatible to those of commercial jet aircraft, throughout the Terminal area and until well inside the final approach fix;
- VLJ climb and descent rates are compatible with commercial turbojet aircraft;
- VLJ aircraft can land and depart safely using shorter runways, unusable by commercial jet traffic. Even regional jets require those same longer runways.
- On intersecting runways, VLJ aircraft are capable of routine (LAHSO) Land and Hold Short Operations; and finally
- To enhance traffic integration even more, new procedures that take advantage of VLJ performance and avionics capability can be developed.

In summary, for the near and mid term, Very Light Jet technology will not only bring point-to-point travel convenience and enhanced economic development to

many smaller towns and cities, it will do so with minimal impact on the existing crowded hubs frequented by traditional air carriers.

En Route Operations

It has been suggested that VLJs will cause or exacerbate en route traffic congestion, either by their growing numbers or because of their somewhat slower (mach .64) cruise speeds. This is certainly not the case in the near to mid-term.

There is ample available en route airspace to accommodate new aircraft, even with today's antiquated ATC system. Commercial jet traffic will continue to dominate in the higher altitudes. VLJ operations will generally be on shorter routes under 600 statute miles and mainly at altitudes below those of longer-range commercial operations.

Sometimes, especially on longer stage lengths, VLJs will want or need to operate at the higher altitudes, but even then VLJs will not disrupt en route traffic flows, even though they cruise at 0.64 mach, slightly slower than commercial airliners. Current Flight Management System (FMS) technology already enables faster moving aircraft to establish offset tracks so as to pass slower aircraft en route. And in the near future, the addition of high altitude "tubes" with passing lanes should enhance that capability.

The General Question of VLJ Speed Compatibility – Terminal and En Route

In the ongoing debate about the impact of VLJ operations, the question of VLJ speed compatibility has been raised frequently. In large measure, this is a red herring. The commercial and business fleets of today operate at a variety of climb, cruise, descent, and approach speeds, based not just on aircraft type, weight, and performance differences but also on variations in company policies. Even with today's 1950s ATC technology, controllers are able to integrate traffic of varying speeds quite efficiently, so VLJs will add no significant complexity.

Air Traffic Operations – Mid-to Long-Term VLJ Impacts

We have discussed the near-to mid-term integration of Very Light Jets into NAS operations and concluded that their impact will be minimal. It's time to take on the larger question - will the VLJ prove to be a "disruptive technology" in the mid- to long-term?

Often the term "disruptive technology" seems to have mostly negative connotations, perhaps due to the havoc such technology can sometimes create in an industry or institution that fails to recognize and adapt to change. Yet "disruptive technology" is generally a positive thing in the longer term and is accompanied by periods of exciting growth. Such periods of innovation and growth should be expected and encouraged, if our goal is for the U.S. economy and domestic productivity to continue to grow.

VLJ technology could have this kind of substantial positive economic impact and could emerge as a "disruptive technology," but the results may also create increased demand for ATC and airport services:

- By bringing personal and on-demand travel within the reach of the small business and middle class user, the VLJ may usher in a new paradigm of personal travel freedom and mobility. This could result in substantial, as yet unanticipated, increases in future travelers and NAS operations, with increased congestion in en route airspace;
- By providing a jet aircraft tailored to serve smaller airports and markets, the VLJ can broaden airport usage in the NAS to include many more currently under-served airports. This could mean increased demand for terminal services at those airports;
- By answering the need for personal and on-demand point-to-point air service, driven by user needs, the VLJ can enhance domestic productivity and economic activity, while linking smaller markets directly to the domestic and global economies. This could generate increased needs for VLJ cargo operations.
- By including a fully integrated aircraft and avionics platform, the VLJ can assume a leadership role in advancing the JPDO NGATS, by assuring that VLJs will be full and efficient participants in the NGATS of tomorrow.

All this new activity could add to the scope of the overall NAS congestion problem, which is largely focused on hub airports. A convergence with

possible new terminal demand at VLJ airports, plus increased en route operations, could be the makings of an ATC “Perfect Storm” of gridlock.

The Solution – Demand Management or Capacity Enhancement

Regrettably, instead of concentrating our collective efforts on capacity enhancement and NGATS, there are those who favor demand management solutions. In particular, the idea of user fees or other surcharges for Regional Jets has re-emerged for VLJs. This is an unfortunate and distracting debate.

Demand management is a flawed concept that constrains innovation and economic activity, while distorting market forces. If a new era of personal travel options is possible, we should do everything possible to encourage the development of an NGATS in which traditional air carrier services can operate in harmony with personal air vehicles such as VLJs. We should not try to constrain or inhibit innovation by disincentives such as demand management.

Instead of wasting time considering ways to generate higher fees in support of current inefficient, antiquated systems, shouldn't we tackle the real problem? Isn't it time for the FAA, Congress, and industry to make jointly a full commitment to a Next Generation Air Traffic System?

Conclusion

Very Light Jet technology may represent the beginning of a new and exciting era of increased personal and on demand

travel. If the business model succeeds, VLJ technology can broaden usage of the NAS and its under-served airports, and it can boost the economies of small to medium sized communities, which today may lack adequate point-to-point connections to domestic and global market places.

Such a potential revolution in personal travel can have significant beneficial effects on domestic productivity and economic growth, but “disruptive technologies” sometimes leave casualties in their wake, often because the institutions and industries affected either fail to recognize the paradigm shift or else refuse to deal with it.

Time is growing short. FAA, Congress, and industry should recommit to forging with all possible speed the partnership necessary to assure timely transformation of our antiquated air traffic management system into the scalable, network-enabled system of systems required to satisfy tomorrow's demand, and in so doing assure continuing U.S. economic growth and opportunity.

¹¹ JPDO. Next Generation Air Transportation System Integrated Plan. U.S. GPO: Washington, 2004. P.2.

² Ibid. P.i.

³ Levin, Alan. “High Tech Gizmos Propel Aviation into the Future.” USA Today: Washington, 2005.

⁴ The Boeing Company. Current Market Outlook. The Boeing Company: Seattle, 2005. P. 11.

⁵ Ibid.

⁶ Ibid.

⁷ JPDO. Next Generation Air Transportation System Integrated Plan. U.S. GPO: Washington, 2004. P. 5.

⁸ Christensen, Clayton M. The Innovator's Dilemma, When New Technologies Cause Great Firms to Fail, Harvard Business School Press: Cambridge, 1997. P. xv.

⁹ Ibid, Page xv.

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