Shifting Paradigms:

Manufacturer-based Safety Programs to Support Very Light Jet (VLJ) Operators

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Abstract

Very Light Jets (VLJs) constitute a landmark development in aviation. They offer the potential, through unprecedented advances in capability and value, to significantly improve access for light aircraft operators to the safest and most efficient aviation operating environments. By virtue of this improved access, VLJs will also drive the system to change in multiple areas, including corporate, air-taxi, and charter flight operations, general aviation, air traffic control, and global airspace systems. This dynamic, developing environment has the potential to engender significant risks and hazards if not managed proactively. Key system components present in commercial, military, and large corporate operations to manage safety risks are voluntary programs addressing continuous risk monitoring through flight data analysis and self-reporting. The power of these programs lies in the capability to identify and analyze hazardous systemic trends. However, the cost of data collection and personnel required to analyze and mitigate risks, combined with the lack of statistically significant fleet sizes, makes implementation in small fleet and individual operator environments prohibitive. In the case of VLJs, these small fleet and individual operators will now be operating in a developing environment, where proactive risk management will be essential to mitigate the hazards inherent in a changing system. To match the major paradigm shift occurring with the introduction of VLJs into our aviation system, an equally major shift in proactively managing risk must occur. One potential solution for VLJs is the concept of manufacturer-hosted safety programs, bringing the power of large fleet data analysis and resource-rich Safety Management Systems to customers with a fraction of the resources needed to manage such programs.

The Changing Environment

In an industry known for slow and conservative development, the rapid advent of the Very Light Jet (VLJ) has generated significant controversy and speculation. Concerns over the effects of this unique category of aircraft on the National Airspace System (NAS) are common. Despite these concerns, the initial sales response from individual owner/operators, corporate operators, air taxi services, and charter operators indicate a concrete market demand which will make effective integration of VLJs into the NAS mandatory.

VLJs have frequently been deemed a *disruptive innovation*[1], with the potential to displace the current dominant technology and drive significant changes in aviation. The cost vs. capability proposition of VLJs creates the opportunity to bring safe, efficient, on-demand transportation in the upper flight levels to significantly more people than ever before. With this opportunity comes significant change, and with significant change comes potential risk. The introduction of light, general aviation (GA) aircraft into Reduced Vertical Separation Minimum (RVSM) airspace, complex jet departure and arrival procedures, and busy terminal areas may create unnecessary hazards if not dealt with proactively. Some of these postulated risks may be unfounded, and others may be undiscovered, so to effectively manage this risk the aviation industry must create a nimble and responsive environment to effect change and assimilate VLJs safely. Unfortunately, the aviation industry is known for anything but being nimble and responsive, with changes taking place over decades instead of months. To foster a more responsive system, we must utilize the latest strategies and technologies for managing risk in aviation.

One of the most significant innovations in aviation risk management has been the utilization by Part 121 and 135 operators of voluntary programs for monitoring, analyzing, and proactively correcting hazards in flight operations. Programs such as Flight Operational Quality Assurance (FOQA)[2] and the Aviation Safety Action Program (ASAP)[3] provide critical insight into operational risks that were previously unknown or lacking in quantifiable data. These programs, or programs like them, have enjoyed definable success and shown significant global growth. These objective (FOQA) and subjective (ASAP) data analysis and corrective action programs are ideally suited to combat potential safety risks in the dynamic environment surrounding VLJ integration, however, there are several key roadblocks to applying them to this segment. First, regulatory guidance and rules affecting FOQA, ASAP, and similar programs worldwide

[1] Christensen, Clayton M.;Raynor, Michael E. (2003). *The Innovator's Solution*. Harvard Business School Press.
[2] AFS-230 (2004). *Advisory Circular120-82 - Flight Operational Quality Assurance*. U.S Department of Transportation, Federal Aviation Administration.
[3] AFS-230 (2002). *Advisory Circular120-66B – Aviation Safety Action Program*. U.S Department of Transportation, Federal Aviation Administration.

are targeted at large, Part 121 and 135 certificate holders, so the protections and incentives so vital to their success may be lost with Part 91 operators due to simple legislative semantics. Additionally, many VLJ operators will be individuals and small corporate fleets, lacking the resources needed to implement the technology and manpower required to effectively manage these programs. Finally, the most significant value in programs such as FOQA and ASAP comes from the aggregation of large amounts of data to allow quick and effective identification of systemic trends. Individual and small fleet operators lack the number of aircraft and pilots required to create a statistically significant pool for effective trend analysis.

The Manufacturer-based Safety Program Concept

One solution for bringing these successful safety programs to the VLJ community is to shift their management from the aircraft operators to the aircraft manufacturers. In a model system hosted by a manufacturer, the benefits of a large organization Safety Management System (SMS) can be transferred to small operators. Not only do these small operators benefit from resource-intensive risk management programs previously reserved for large operators, but they can effectively be integrated into a larger safety community, ideally absorbing the safety culture promoted by the manufacturer and learning from the lessons of others. The manufacturer effectively becomes the equivalent of the Part 121/135 management, analyzing and managing risk for its operator community in a systemic way, instead of leaving their customers to fend for themselves.

FOQA for VLJs

Due to the relatively new designs of VLJs, as well as other Technically Advanced Aircraft (TAA), many manufacturers now have the capability to easily capture high-quality aircraft data allowing effective FOQA program execution. While airlines have effectively utilized manual retrieval using mailed removable media for many years, VLJ designs may allow more efficient data retrieval via removable media to internet upload, Wireless Local Area Network (WLAN) access points, and satellite data links (figure 1). These seamless or near-seamless methods of data retrieval are essential to achieving high capture rates from operators with limited manpower.

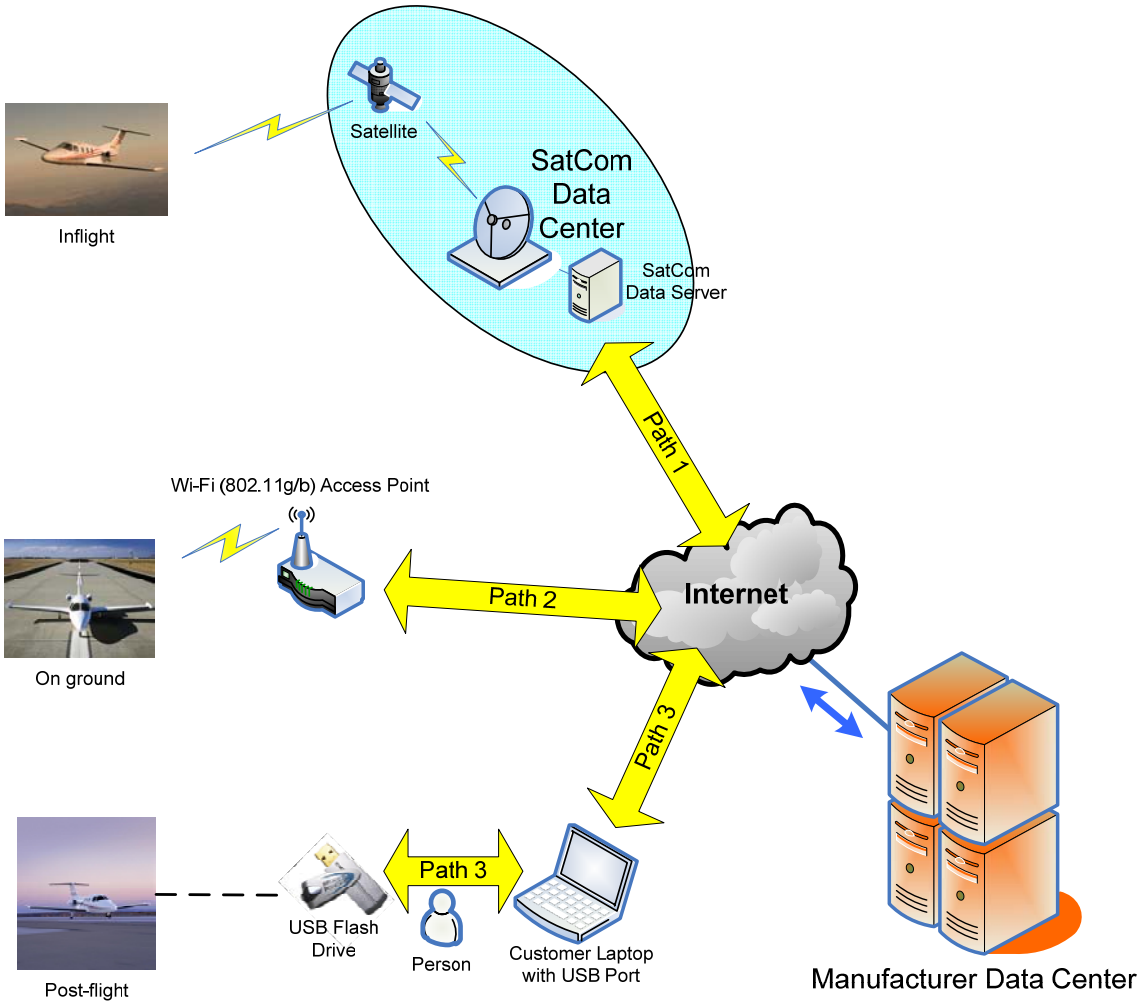

Figure 1

Once the data is acquired, the manufacturer can analyze it just as an airline would to identify adverse operational trends. These trends are then addressed by a review board, equivalent to a FOQA Monitoring Team. Since this program is hosted by the manufacturer, the multi-disciplinary body can consist of representatives from much more diverse areas than the traditional pilot group and management seen in airline FOQA programs. In particular, representation from Flight Operations, Safety, Training, Maintenance, Engineering, and Customer Support will provide a wealth of knowledge and authority to identify root causes and implement corrective actions at the source of the problem.

ASAP for VLJs

While aircraft flight data used in FOQA analysis describe *what* is happening, a comprehensive SMS must have a component to describe *why* events are occurring. This

is particularly important in the manufacturer-based model, as direct interaction with non-employees may be limited and cumbersome. For this reason, manufacturers should develop user-friendly systems for the accurate and efficient collection of subjective textual reports from their operators. An ideal system for creating incentive for operators to self-disclose errors is ASAP. Similar to NASA's Aviation Safety Reporting System (ASRS), the ASAP model provides a mechanism for the collection and analysis of subjective human performance data, identification of trends, and implementation of corrective actions. Moreover, a manufacturer-based ASAP would allow more direct and targeted analysis, trending, and correction of safety trends, while providing improved, comprehensive protection from FAA enforcement action over ASRS.

ASAP reports collected by a manufacturer could be reviewed by an Event Review Committee (ERC), just as in an airline ASAP. This committee would consist of a partnership between manufacturer, operator, and FAA representatives. Any corrective actions pertaining to individual operators would be voluntary, but compliance would be a requisite for participating and receiving immunity protection. Once ASAP reports have been accepted by the ERC, they can be placed into a company database.

FOQA / ASAP Integration

If ASAP reports are entered via a defined and precise taxonomy, they can be easily combined and compared with FOQA data to produce truly integrated causal factor identification and trend reporting. The review board analyzing FOQA trends will have the ability to access corroborating and clarifying ASAP data. This comprehensive view into operations, combined with the expertise and knowledge of the manufacturer team, will allow the development of highly-targeted strategies for managing risk (figure 2). Corrective measures may include:

- Procedural changes implemented through the Aircraft Flight Manual
- Engineering modifications to aircraft systems
- Modifications to maintenance procedures and manuals
- Improvements to optimize manufacturer-based training programs
- Operator awareness of risks and recommendations through personal and mass communications
- Advocacy for modification of ATC procedures adverse to VLJs

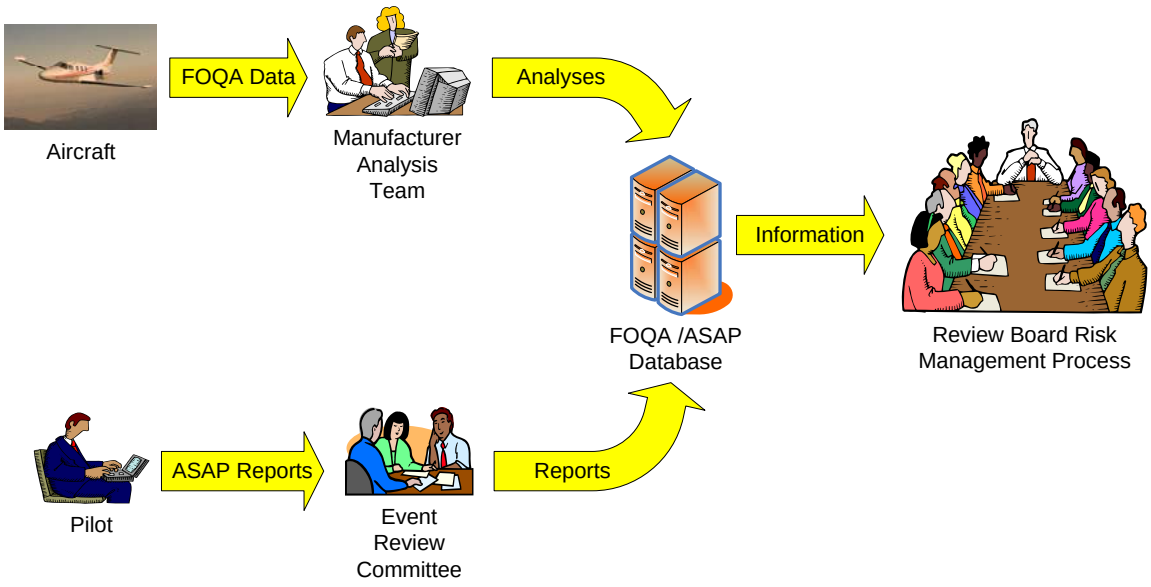

Figure 2

Challenges and Solutions

Although the obstacles to implementing these changes are numerous, they are not insurmountable and carry a reward well worth the effort.

Data Collection

In an ideal model, data will be seamlessly captured by the manufacturer via wireless or satellite technology. However, this will likely not happen in the near term and data collection will be dependent on some voluntary operator participation. While a 100% capture rate is unlikely in any model, there are various methods to improve the rate, and a combination of several strategies will generate the best results. Some motivating and failsafe strategies are:

- Provide feedback to the operator after uploading flight data for FOQA analysis, including tailored event reports.

- Deliver useful products in response to uploading flight data, including electronic log book records, flight animations, and tailored efficiency reports comparing individual aircraft performance with fleet averages.

- Ensure onboard memory allows sufficient storage of flight data enabling capture at company service centers during major maintenance intervals, if customer fails to upload periodically.

- Implement contractual obligations to provide flight data as part of factory service agreements or manufacturer-supported discount insurance programs.

- Demonstrate usefulness of FOQA and ASAP data by periodically communicating system successes to all operators.

- Create incentive to provide self-disclosure reports through ASAP by enabling immunity from enforcement action. This will require FAA modification to the ASAP Advisory Circular, as it is currently specifies applicability to Part 121 Certificate Holders only.[4]

Privacy

FOQA and ASAP programs hosted by Part 121 and 135 operators have the benefit of an employer/employee relationship, whereby the participants expect certain limits on personal privacy while operating company aircraft. Additionally, the company itself maintains competitive privacy by containing their programs in-house. In the manufacturer-based model, there may be concerns from small fleet operators and individual owner/operators with privacy and proprietary issues. The primary way to combat these concerns is to institute a program with a core philosophy minimizing individual distinction and employing robust security and privacy mechanisms, and to fervently educate the participants as to the core protections inherent in the system. For example:

- The program description in the FAA-approved FOQA Implementation and Operation Plan, as well as the ASAP Memorandum of Understanding, should emphasize the core intent to identify and correct *systemic trends* using aggregated data, as opposed to identifying individual issues.

- Any contractual obligations for operators to provide data should include non-disclosure stipulations placed upon the manufacturer.

- Manufacturers should seek FAA approval for FOQA programs to ensure protection from FAA use of FOQA information for enforcement purposes, as well as protection from FAA disclosure of FOQA information.[5]

- Any individual communications regarding FOQA or ASAP information with operators should be governed by policies ensuring strict confidentiality and limited long-term availability of identifying data.

- Any dissemination of FOQA or ASAP information outside of the manufacturer should be de-identified and aggregated to show trends only.

[4] AFS-230 (2002). *Advisory Circular120-66B – Aviation Safety Action Program*. U.S Department of Transportation, Federal Aviation Administration.
[5] Title 14 of the Code of Federal Regulations (14 CFR), Part 13, Section 13.401, and Part 193.

- Ideally, FOQA and ASAP-related communications should come through a neutral party, such as a non-company mentor instructor or owner/operator group representative, similar to the FOQA gatekeeper concept.

Corrective Actions

The success of risk management programs like FOQA and ASAP hinges upon the ability to go beyond simply identifying problems and close the loop by implementing and monitoring corrective actions. As with privacy concerns, the employer/employee relationship in the traditional Part 121/135 program affords a clear line of authority to implement individual and systemic corrective actions within flight operations. Manufacturers are aptly capable of effecting system-wide corrections to flight manual procedures, training syllabi, engineering designs, maintenance procedures, ATC procedures, etc., but lack the authority to enforce specific actions involving individual owners or small fleet operators, such as retraining or changes in standardization or standard operating procedures.

In the case of FOQA, this is not a serious issue, as most corrective actions usually address systemic trends and involve system-wide solutions at the basic operating procedures level. For those issues with solutions not leading back to manufacturer-defined procedures, simply communicating the nature, scope, and severity of risks along with recommendations has proven to be a highly effective means for correcting adverse operator trends.

For ASAP, the ability to enforce corrective actions is much more significant, since FAA immunity from enforcement action is partly based on the ability of the program operator to take steps to prevent further occurrences when risks are identified. Since ASAP events are initially evaluated individually before granting immunity, there is more probability of them involving individual corrective actions. Unfortunately, the manufacturer does not have the authority that an employer has to correct an individual problem, nor do they have the authority to correct problems isolated to a small fleet operator. One solution to this dilemma is to make voluntary participation in a manufacturer's ASAP contingent upon accepting corrective actions determined by the ERC. If the participant does not agree to implement the recommended actions, then the event is no longer protected under ASAP rules.

Benefits

It is apparent that providing manufacturer-based ASAP and FOQA programs is better than having individual and small fleet operators with no programs at all. There are, however, additional benefits to the manufacturer-based concept, applicable to all ASAP and FOQA programs.

- The manufacturer has the ability to truly integrate ASAP and FOQA information in the risk management process. This concept is frequently proposed but difficult to implement for Part 121/135 operators due to organizational impediments to open information sharing.

- The manufacturer is ideally suited to ascertain root causes and make changes to engineering, manufacturer-hosted training programs, procedures involving aircraft and maintenance manuals, and aircraft type-specific ATC issues.

- The manufacturer can aggregate the largest statistical pool of a single type of aircraft, providing the clearest, quickest picture of systemic trends.

- With the largest amount of data and clearest statistical results, the manufacturer has the greatest leverage for effecting change with VLJ integration in the NAS.

VLJs and the Road Ahead

The VLJ revolution is upon us with the promise of bringing safe, efficient, and convenient personal, corporate, and public travel to more people around the globe than ever before. With this revolution in air travel comes great change. If neglected, this change could grow into increased risks, reducing safety for all aviation sectors. The success of Part 121 and 135 ASAP and FOQA programs illuminates a perfect opportunity to gain the insight needed to address change and risk in the VLJ world. Manufacturers are ideally situated to manage these programs, creating airline-quality safety cultures for this new, diverse sector of aviation. If managed effectively, through increased awareness of risks along with proactive action to eliminate or minimize those risks, the VLJ revolution will become a smooth and welcome milestone in the advancement of aviation.