# U.S. General Aviation System: Potential for Growth

## An AIAA Information Paper

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### Overview

The general aviation industry in the United States is at a critical juncture in its recovery from the devastation it suffered during the past decade, during which it lost its former leadership in the global market. The industry is beginning to show evidence of emerging from that precipitous fall, thanks in part to the Revitalization Reform Act of 1994, which limits the manufacturers' liability. Piper is now making a profit and is poised to emerge from bankruptcy. Cessna has selected a site to restart production of its single-engine aircraft line. New start-up manufacturers such as Global Aircraft are on the verge of fielding new certified designs. U.S. manufacturers of helicopters, higher-

end business jets, and turboprop aircraft are once more becoming a force in the highly competitive world market.

However, the general aviation industry, with its wide scale of flight operations, manufacturing, materials, and technology implementation, cannot afford an environment or an infrastructure that imposes unnecessary costs or constraints. To do so at this critical time in the industry's recovery would stifle the industry's return to high-volume production, along with the thousands of potential jobs that go with it. The cost reductions achievable with a new, less obtrusive, distributed aviation infrastructure would accrue not only to general aviation, but also to the airline industry and the government as well.

In restructuring U.S. aviation operations and government regulatory agencies, it is important that the present bureaucracy is not simply transferred to industry. Instead, the restructuring offers a unique opportunity to develop a new approach to managing air transportation based on currently available technologies and methods. In designing that new approach several specific needs might be considered:

(1) An "open" rather than a restricted airspace demonstration program; that is, one which includes the concepts of autonomous aircraft and self-separation.

(2) Expansion of new public-private partnership mechanisms to implement a cohesive program for introducing new technologies and methods into the revitalization of general aviation.

(3) Legislation that provides tax incentives to cities and towns for single-runway landing strips, to facilitate the introduction of new low-cost technologies.

(4) Full, continuous, and affordable access to high-accuracy Global Positioning System navigational signals at small airports.

**Background**

General aviation is defined to include all aircraft operations except airlines, commuter operators, the military, and the Coast Guard. Current general aviation activities consist of business, utility, flight instruction, agricultural, package delivery, personal, recreation, and a host of other applications. The future general aviation mission in the U.S. also encompasses the potential for serving rural and small community transportation markets not currently served effectively by ground transportation or the commercial airlines; i.e., mid-speed (150-250 knots), mid-range (100-750 miles) markets.

Movement by air is an important and critical part of the U.S. transportation system. Nearly 500 million people board airliners every year; it is noteworthy that even in its current depressed state general aviation aircraft carried an additional 80 million people in 1993. General aviation also accounted for over 33% of total miles and over 58% of the total hours flown. In addition, 40% of all U.S. instrument flight operations are provided by general aviation. General aviation can provide services to over 18,000 landing facilities (including heliports) in the U.S., compared with 384 served by scheduled airlines in 1993. These figures do not include

the many off-airport sites served by general aviation airplanes and helicopters.

Besides traditional transportation, general aviation aircraft provide other services, such a fire fighting, air ambulance, transportation of vital organs for emergency transplant, police extradition of prisoners, air hearse, transportation of radioactive pharmaceuticals, pipeline and power-line patrol, spraying and planting of crops, and air/sea search and rescue. Helicopters are used for transportation of off-shore oil rigs and construction sites, logging operations, laying of power lines, and many other special operations.

Nevertheless, all airspace users, including but not limited to general aviation, have become more constrained in recent years. The current air traffic control system is personnel-intensive and is based on old technology that reflects its piecemeal or *ad hoc* development. It exacerbates the existing congestion and increases delays. Current air traffic control system user requirements are too complex and expensive for broad acceptance by personal air transportation system operators. In the specific case of general aviation, these characteristics of the air traffic control system, coupled with cost issues concerning aircraft certification and liability, have limited growth and strongly contributed to a gradual decline. The U.S. general aviation industry produced 17,032 piston powered airplanes in 1978, but only 555 in 1993. In the last ten years the number of active licensed pilots declined 11%; the number of student pilots declined 27%; and the active general aviation fleet declined over 17%. During the period from 1969 to 1992, while the total number of airports served by general aviation increased, airports open to the public decreased by more

than 22%. Although these numbers do not include all categories of general aviation (e.g., jets, turboprops, and helicopters), overall general aviation aircraft shipments in 1993 were down by over 64% from the number shipped in 1983.

**General Aviation Operations**

The technology is in hand to stimulate growth of the general aviation transportation system. No new technological "breakthroughs" are required. Implementation of these technologies can meet the fundamental requirements for general aviation airplanes and the air traffic control system, including the development of a supporting infrastructure that provides the traveling public with an affordable, easy-to-use general aviation transportation system.

It is generally agreed that the present system for general aviation airplane operation and air traffic control is difficult to master for all but the most dedicated users, because we are using fifty-year-old, complex technology and procedures which do not capitalize on current technical advancements. The use of available technology can radically change the ability of a larger population to use general aviation.

If general aviation flight operations were made easier, they could supplement airline travel for trips of 100 to 750 miles for a substantial number of travelers. The utilization of new technologies, designs, and procedures could decrease the overall cost of general aviation operation through attendant efficiencies and economies of scale.

The "free flight" technique for navigation, which has recently been identified as an airline money-saver, is "standard practice" in general aviation. General aviation aircraft operating under Visual Flight Rules (VFR) conditions go "direct" to a destination, without constraints. The use of new, currently available technology would make Instrument Flight Rules (IFR) operations as easy, efficient, and flexible as VFR operations. It would change our concept of managing air traffic and benefit the airlines as well as general aviation.

Continuing the current air traffic control system philosophy and methodology, whether operated by a government agency or other organization, would continue to inhibit the use of the system by general aviation because of both the system’s complexity and its high recurring costs to individual aircraft owner-users. Many of these recurring costs for air traffic services would be unnecessary under a more modern concept of air traffic management using available technology.

The development of Global Positioning System (GPS) navigation and data-link communications are changing the way we look at air traffic control and general aviation operations. It is now possible to think in terms of greatly reduced operational complexity, with GPS-based systems providing enroute navigation, approach, and traffic awareness for a truly autonomous cockpit and thereby minimizing the requirements for air traffic control.

**Specific Needs**

Current and emerging technologies, along with their associated techniques, can significantly affect the

productivity of air traffic. Choices range from the existing labor-intensive ground-based infrastructure to transferring many of the separation assurance functions to the aircraft and pilot, with strategic air traffic flow management retained as a centralized function. The latter choice would reduce the need for the aviation agency to acquire large ground-based infrastructure, which historically has been difficult to implement. Alternative approaches need to be examined, with close attention given to recurring costs that will be levied on aircraft users and operators (both general aviation and air carriers) to insure that the survivability of the aviation industry is not compromised simply to retain now-obsolete air traffic management paradigms.

A factual basis for such an examination could be established by having the aviation agency and NASA develop an "open" rather than a restricted airspace demonstration program; that is, including the concepts of autonomous aircraft and self-separation. Simplifying airspace structure and air traffic management, and transferring tactical flight management and separation functions to the aircraft, could significantly reduce recurring costs to all operators relative to the costs of current air traffic control functions.

NASA’s existing Advanced General Aviation Transport Experiment (AGATE) consortium is expanding the utility of general aviation technology and operations through its use of new public-private partnership mechanisms. Along with NASA Small Business Innovative Research (SBIR) and technology transfer agreements directed toward general aviation, these initiatives have focused the fiscal resources of government, industry, and the universities into a cohesive

program to introduce new technologies and methods into the revitalization of general aviation.

These initiatives typify the new U.S. trend toward government-industry cooperation which is replacing the adversarial relationship of the past. The AGATE program, in particular, features the pre-competitive cooperation which fosters technological progress that cannot be achieved by one company alone. This type of mechanism has been used with great economic success in Japan and, to a lesser extent, in Europe.

The building of general aviation infrastructure could be significantly enhanced by legislation that provides tax incentives to cities and towns for single-runway landing strips. Such legislation would maximize the cost benefits of Global Positioning System (GPS) technology, which now allows full operational utility at a landing strip without high-cost ground-based landing systems and associated equipment.

Satellite-based navigation is the keystone technology in the advancement of modern navigation and air traffic management methodologies. In the planned transition to an infrastructure based on the Global Positioning System (GPS), it is essential for pilots to have full and continuous access to navigational signals with sufficient accuracy to perform the required aviation functions in all phases of flight. The accuracy is most critical at airports (there are over 13,000 in the U.S.) for landing approaches and taxi guidance. The functions can be provided using available techniques that are (a) affordable to small airport operators and (b) do not require large government investments,

because such investments eventually imply high recurring costs to all aircraft operators.

## Conclusion

Public access to general aviation is at a crossroads. With careful choices, there is now an opportunity to make general aviation services more affordable and accessible, while revitalizing an industry that can provide thousands of jobs at all skill levels; for example, in maintenance, service, business management, engineering, and research, to name a few. The structure that will be established during the next few months to manage the national airspace system will affect the regulation of aviation in this country for the foreseeable future. It would be most gratifying if this structure would allow aviation to remain affordable and accessible to the people of the nation who were "first in flight."

## Reference

"The Role of Technology in Revitalizing U.S. General Aviation," Report of an AIAA Workshop, May 1990.