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Mr. Chairman, Senator Breaux, and members of the Subcommittee, my name is Edward M. Bolen and I am President of the General Aviation Manufacturers Association (GAMA). GAMA represents approximately 50 manufacturers of general aviation aircraft, engine, avionics and component parts located throughout the United States.

GENERAL AVIATION

As everyone on this Subcommittee well knows, general aviation is defined as all aviation other than commercial and military aviation. It is the backbone of our air transportation system and is the primary training ground for the commercial airline industry. It is also an industry that contributes positively to our nation's economy.

General aviation aircraft range from small, single-engine planes to mid-size turboprops to the larger turbofans capable of flying non-stop from New York to Tokyo. These planes are used for business purposes and recreation, as well as everything from emergency medical evacuations to border patrols and fire fighting. They are also used by individuals, companies, state governments, universities and other interests to quickly and efficiently reach the more than 5000 small and rural communities in the United States that are not served by commercial airlines.

GROWTH IN GENERAL AVIATION MANUFACTURING

Since passage of the General Aviation Revitalization Act (GARA) in 1994, general aviation manufacturers have posted six straight years of increased billings and increased shipments. That is quite an accomplishment.

Product liability reform has allowed general aviation manufacturers to allocate valuable resources toward research and development of new, exciting, safe and environmentally friendly products to the market. In addition to private research being conducted by many GAMA member companies, we are working in conjunction with NASA on their research programs for general aviation.

NASA RESEARCH IS CRITICAL TO U.S.

NASA research plays a critical role in the future of the U.S. aeronautics industry. The U.S. has maintained its world leadership in aeronautics because we have long understood that basic scientific and technical research is an appropriate government function.

It is especially important to understand now that the Europeans have published a public document, "A Vision for 2020", stating their goal to wrest the leadership in aeronautics research from the U.S. They have proposed a broad range of research and development programs and educational efforts recommending $93 billion be invested in the next 20 years.

At GAMA, we believe NASA research is critical to our nation's competitiveness. This type of research is long term, very high risk, and would not normally be justified by any commercial company. It is undertaken well before commercial products are developed, at the "pre-competitive" level. In fact, experience has shown that a company may still need to invest hundreds of millions of dollars to take a NASA-developed technology and bring it to the marketplace.

One example that may be helpful to you in understanding the competitiveness issue is in the area of high-speed civil transport. Supersonic speed is largely viewed as the next frontier for intercontinental business jets. However, due to budget shortfalls, NASA is no longer funding this program. Meanwhile, France, Russia and Japan are each pursuing a supersonic business jet program.

NASA aeronautics research is an investment in the future, and the primary beneficiary is the traveling public, who benefits from a safer, more efficient, environmental and economical air transportation system. But as the nation's air transportation system continues to grow, so do environmental concerns.

This year's NASA budget funds two programs worth mentioning here. First is the Ultra Efficient Engine Technology program. It is focused on researching advanced

technologies to reduce emissions. Second is the Quiet Aircraft Technology program. This important program seeks to find solutions for reduced jet noise. Both should continue to receive Congressional support. NASA research will make revolutionary changes in both areas possible.

Other beneficiaries of NASA research are the employees of aerospace companies holding the high-paying jobs needed to produce these new products. And as the result of NASA's research eventually enters into the public domain, manufacturers based outside the U.S. also reap the benefits of NASA's investment.

Given the benefits NASA's research provides to the nation's economy, we strongly support the continued allocation of general taxpayer dollars to the NASA Aeronautics budget.

BENEFITS OF NASA RESEARCH

In my testimony today I thought I would talk about the benefits we have already received from NASA research programs, as well as some of the technologies that are being developed as a result of NASA's focus on general aviation.

The Advanced General Aviation Transport Experiment (AGATE) was a NASA cost sharing partnership with industry to create the technological basis for revitalization of the U.S. general aviation industry. The goal of the program was to develop affordable new technology as well as the industry standards and certification methods for airframe, cockpit and flight training systems for next generation single pilot, 4-6 place, near all-weather light airplanes.

AGATE focused attention on moving technology that had been available only to commercial air carriers to general aviation aircraft. NASA and industry worked closely with FAA to bring electronic display regulations into line with current technology. As a result, we will soon see new avionics in general aviation aircraft that are cheaper, more reliable and provide better information to the pilot, advancing the safety of our industry.

Another success of AGATE has been the streamlined certification standards for composite materials. Composites are lighter weight than steel and provide unique benefits for fuel efficiency.

NASA's General Aviation Propulsion (GAP) program aimed to develop revolutionary new propulsion systems for general aviation. Historically, it is new engines that have brought about the greatest changes in aircraft design and performance. At the entry level of general aviation, some very exciting new engines are on the verge of reaching the market.

New Engine Technologies

One of the most exciting engine developments is from Williams International, the new FJX-2 turbofan engine. Planned to weigh one hundred pounds or less, it will produce at least 700 pounds of thrust. With an extremely economical price, the Williams engine could be a feasible choice for even the smallest airplane.

Teledyne Continental Motors and Textron Lycoming are developing a new generation of internal combustion engines, with distinct advantages over current piston-powered engine designs. First, the number of moving parts is greatly reduced, simplifying both engine production and maintenance. This also reduces weight and engine noise while improving reliability. Equally as important, these engines will be able to use jet fuel. The result will be an engine with better performance and high reliability, but much lower cost.

Teledyne Continental Motors' engine is due in part to the Internal Combustion Engine Element of NASA's GAP program. The goal of this element of the GAP program was to reduce engine prices by one half while substantially improving reliability, maintenance, ease of use, and passenger comfort.

In addition to new engines, these manufacturers are also developing new electronic engine controls that will not only add to the performance of new engine designs, but could greatly improve performance of the existing piston-engine fleet. Single-lever power controls will simplify engine operations and reduce the potential for operator error. Teledyne Continental Motors is developing a new Full Authority Digital Engine Control system, or FADEC, which incorporates an innovative microprocessor architecture designed to provide a high degree of redundancy. This product has been developed as a result of AGATE.

Another engine control product, developed outside of the AGATE Consortium, is Lycoming and Unison Industries' Electronic Propulsion Integrated Control system, or EPiC program. EPiC is a completely integrated digital propulsion system for new certified piston-powered aircraft that will provide exact engine propulsion management.

Likely to complement the new engines are new propeller designs by companies like Hartzell. These new propellers will not only improve efficiency, but they will also make smaller airplanes even quieter than they are today.

But what benefits to our aviation system will these new engines bring? The future general aviation engines will have dramatically reduced emissions and noise and will be extremely fuel efficient at a low cost. Their reliance on jet fuel is a major breakthrough given the environmental concerns over continued use of leaded aviation gasoline in today's general aviation piston engines. Last, although certainly not least is safety. The new engine technologies will bring a greater measure of safety to flight through enhanced

reliability and easier maintenance due in part to the fewer moving parts found in these engines.

New Avionics Technologies

Building on the FAA's National Airspace System (NAS) modernization plan and the Global Positioning System (GPS), general aviation manufacturers have been busy developing new products that will dramatically increase safety and efficiency of the current aviation system.

NASA also makes significant contributions to advanced air traffic control procedures and equipment. We are pleased that the FAA and NASA have worked closely to coordinate their ATC research activities, and avoid duplication of efforts and leverage resources as much as possible. This NASA–FAA partnership is working, and should continue.

Once the Wide Area Augmentation System (WAAS) is certified by FAA, a new generation of GPS/WAAS receivers from companies like GARMIN, Honeywell and UPS Aviation Technologies will be brought to market. These receivers will offer fast and easy access to basic navigation functions, and there will be standard function labels and abbreviations regardless of equipment manufacturer.

As our industry continues to benefit from laptop computer-display research, we can expect cockpit displays in smaller aircraft to become even more sophisticated and less expensive than they are today. As a result, advanced multi-function displays (MFD) similar to the ones currently manufactured by Avidyne, Rockwell Collins, Honeywell and others will be ubiquitous.

When coupled with a GPS/WAAS receiver, these new multi-function displays will not only depict a moving map, but also nearby terrain, engine operating parameters and other important information such as actual fuel burned versus the amount planned. The basic attitude and heading displays of the aircraft will be depicted in such a way that IFR flight can be easily accomplished. These technologies are being developed due in part to NASA's AGATE Consortium.

BFGoodrich, Honeywell, and Universal Avionics have announced Terrain Awareness and Warning Systems, or TAWS, for small GA aircraft. Controlled Flight Into Terrain (CFIT) is a leading cause of general aviation accidents. With situational awareness technology in the cockpit, pilots will have information at their fingertips about the terrain over which they are flying.

Also to help address CFIT accidents, NASA and the FAA are cooperating on a five-year program to develop synthetic vision systems. Synthetic vision combines GPS with a precise terrain database to provide the pilot with the equivalent of daytime, clear weather view of the surrounding terrain even if the pilot is actually flying in nighttime, bad weather conditions.

Companies like Avidyne, GARMIN, Rockwell Collins and Honeywell are working on products that will allow near real-time weather and weather forecasts to be displayed in the cockpit via ground-to-air or satellite datalink. Weather is the leading cause of general aviation accidents. Datalink will provide timely weather information in the cockpit so pilots can make better decisions about whether or not to proceed to their destination. NASA's Aviation Weather Information System (AWIN) is focused in these areas.

The FAA is field testing in the Ohio Valley and Alaska ADS-B products by UPS Aviation Technologies that will allow traffic information to be automatically displayed via air-to-air datalink from nearby aircraft. This new technology allows pilots in the cockpit and air traffic controllers on the ground to see air traffic with more precision than radar and other tools allow. By relying on the GPS signal, pilots will see precisely where aircraft near them are and will know their intentions. Importantly, ADS-B could permit the airspace to be more efficiently utilized, increasing capacity and reducing delays in the system.

Looking at all of these exciting new technologies, it is easy for me to get very enthusiastic about the future of general aviation, and I haven't even mentioned some of our great new training products, autopilots, or some of the advances being made by some of GAMA's component manufacturers.

These new technologies will yield both improved margins of safety and increased operating efficiencies. The margin of safety will be dramatically improved when every paved and lighted airport in our nation can offer an instrument approach with vertical guidance. And when aircraft can fly on nearly any route they choose, and still be assured they remain well-clear of conflicting traffic or terrain, we will have achieved a new era of efficiency and safety for both aircraft operators and passengers alike. Finally, the safety benefits of timely weather information provided to pilots in the cockpit through datalink cannot be understated.

Building on all of these emerging technologies, GAMA believes there is a significant role for general aviation in our nation's future air transportation system.

GENERAL AVIATION'S ROLE IN THE NATION'S FUTURE AIR TRANSPORTATION SYSTEM

As this committee well knows, general aviation provides critical access today to communities not served by air carriers. It connects small communities and businesses to the economic mainstream. Without access to airports, local officials would not be able to attract new business and economic investment in their communities.

However, if general aviation can be more efficiently utilized, and we believe it can, then we can help to solve the capacity problems currently facing the air transportation system. With hub airports approaching gridlock at an ever-increasing pace, capacity of the current

system is a legitimate concern. Improvements in the technology of general aviation aircraft, avionics and engines will make general aviation for a growing number of people an even safer, more reliable and affordable alternative to today's commercial air transportation system.

This is also the vision of NASA's Small Aircraft Transportation System (SATS). The goal of SATS is to develop an innovative solution to air transportation delays. By dramatically increasing the reliability and safety of general aviation aircraft, air travel can be transformed.

SATS is focused on achieving these goals through advancements in aviation technologies. These technologies include advanced flight controls and innovative avionics for near-all-weather access to any airport. In addition to aircraft technologies, NASA is focusing on investment in airport infrastructure. The program envisions the safe use of general aviation airports without additional control towers, radar or additional runway protection zones. Enhancing general aviation access to the over 5,000 airports across the nation greatly increases the capacity of our air transportation system. Rural counties and other areas will economically benefit from the increased access and capacity the SATS-developed technologies will bring.

Another major focus of the SATS program has been to encourage smarter manufacturing techniques by drawing on automotive manufacturers' expertise. NASA has shown today's manufacturers of general aviation aircraft that mass production is possible if we incorporate some of the automakers' best practices into general aviation manufacturing. And basic economics tells us that increased production will drive down costs, making these more efficient, safer products more affordable for general aviation pilots.

SATS also has a goal to reduce pilot training and proficiency requirements through increased use of safety-oriented technologies. When these technologies are deployed, access to personal aircraft travel will increase dramatically.

I know that there are those who may question whether my vision for the future of general aviation is realistic. They may argue that the challenges to growing our industry are too great and our resources are too few.

But I would remind those people that, for nearly a hundred years, those of us in aviation have delighted in proving naysayers wrong. Like the Wright brothers themselves, we know that with determination and innovation, nothing is impossible.

CONCLUSION

Thank you for the opportunity to testify today. I would be happy to answer any questions you might have.