

Aviation technology

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Although the United States Federal Aviation Administration (FAA) runs one of the safest air transportation systems in the whole world, it is foreseeing an aviation problem caused by increasing passenger numbers and consequently, more crowded skies (U. S. GovernmentAccountabilityOffice [GAO], 2007). The number of passengers is expected to reach 1 billion per year 8 years from now.

FAA (2007) shows concern that if it does not take action, there will be far greater delays than what is being experienced right now, leading to economic losses which could amount to \$22 billion. That is why the agency is starting to institute transformations in its system to address this key issue.

One of these is the transition from the currently-used system to the Next Generation Air Transportation System (NextGen) – a step that promises to prevent gridlock in the skies.

One of the critical components of NextGen is ADS-B, short for Automatic Dependent Surveillance Broadcast, which is considered to be the “ backbone of the NextGen system” and utilizes GPS satellite signals to provide both pilots and air traffic control stations with more precise information to enable a more efficient and safer use of the skies (FAA, 2007).

How Does ADS-B Work?

Unlike radar which involves transmitting electromagnetic pulses and bouncing them off airborne targets and then interpreting reflected signals, ADS-B works by relying on satellite-based GPS system in order to determine the aircraft’s exact position as well as a host of other parameters such as the

aircraft's speed, route, heading, altitude and flight number (“ADS-B”, 2007; “ADS-B Creates a New Standard for Aviation Safety”, 2007).

These information are broadcasted via a radio transmitter and can be received by other aircrafts, ground stations and ground vehicles that are also equipped with ADS-B (Caisso, 2001). Aircrafts and ground control stations within 150-200 miles of the broadcasting aircraft (or

ADS-B ground station) receive the information and display it in an easily understandable format in a computer screen. Pilots can view this information on a Cockpit Display of Traffic Information (CDTI) while air traffic controllers on the ground can see the ADS-B aircrafts on their regular traffic display screen (“ADS-B Creates a New Standard for Aviation Safety”, 2007).

Users of ADS-B are assured of receiving air traffic information in real-time which means that both the pilot and the controller on the ground can both view the same information at the same time.

Benefits of ADS-B

One of the major benefits of ADS-B, as stated earlier, is the ability of both the pilot and the ground station, when both equipped with ADS-B, to view reliable and accurate air traffic information in real time. There will also be less need for aircrafts to continually send and receive signals from ground-based controllers (FAA, 2007). This will lighten the load of air traffic controllers, enabling them to accommodate and serve more aircrafts at a more efficient rate.

The Aircraft Owners and Pilots Association (AOPA) also supports the government's move to pursue ADS-B in lieu of radar and other surveillance

technologies, stating that their members can benefit from ADS-B as it is able to provide graphic weather updates and textual flight advisories (AOPA, 2006).

These information were considered to be an expensive add-on to existing aviation technology resulting to its unpopular use in aircrafts (“ADS-B Creates a New Standard for Aviation Safety”, 2007). Furthermore, AOPA believes that FAA can have enormous savings because ground-based transmitters cost at most \$200, 000 as opposed to radar systems that cost the government millions of dollars.

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Another reason why ADS-B is preferable to radar systems is that aside from it being less expensive than radars, ADS-B updates at least once a second compared to radars which can sometimes take as long as 12 seconds (AOPA, 2006; FAA, 2007). ADS-B also has wider coverage and ADS-B ground station can be put in place more easily than radars. In fact, FAA’s Capstone Program involved equipping airlines and air taxis in Southwest Alaska with the new technology.

The region was particularly chosen because most of the ground is frozen for the whole year making a lot of places inaccessible by land (FAA, 2001). Furthermore, remote areas cannot be reached by radars making the place a perfect testing ground for ADS-B technology. Starting in 1999, the program has continued until at present and has even expanded to include two more phases.

The use of ADS-B has reduced accidents in the Yukon-Kuskokwim River Delta –a place not reached by conventional radar - by 43 percent in 2003-2006 (Stapleton, 2006). The results of the Capstone program proves that ADS-B technology can be used to increase efficiency and safety in aircrafts.

The drop in the number of accidents in Southwest Alaska can probably be attributed to ADS-B's ability to enhance aviation safety by providing pilots with features such as automatic traffic call-outs and warnings of impending arrivals or take-offs in the runway (“ ADS-B Creates a New Standard for Aviation Safety”, 2007).

ADS-B, having a range of more than 100 miles, provides the aircraft with a wider margin in which to detect conflict (e. g. an imminent collision). Compared to existing systems, resolution of conflicts can be enacted within a shorter p of time.

Disadvantages of ADS-B

Benenson (2005) noted a certain disadvantage of ADS-B while flying his Cessna Cardinal, which he equipped with ADS-B UAT (Universal Access Transceiver). It was not

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really a disadvantage of the technology itself but rather to the lack of ground-based transceivers (GBTs) at present. In order for non-ADS-B aircrafts to be displayed in a CDTI, the ADS-B equipped plane must be within the line of sight of a GBT. The GBT sends traffic information coming from air traffic surveillance sensors, most probably radar.

The radar information however is not as accurate as the one received through ADS-B, so the non-ADS-B plane appears in the CDTI distorted. Related to this, pilots who are equipped with the new technology may be over-confident, thinking that he perfectly understands the surrounding traffic, forgetting that only equipped aircraft are able to transmit their position quite clearly (Caisso, 2001).

Evans (2006) tackles more serious issues such as the risk of “spoofing” by individuals whose sole intent is to produce as many false ADS-B targets on an air traffic controller’s screen. Dick Smith, the former head of Australia’s Civil Aviation Authority, was the first to make public the reality of such a risk. He claimed that spoofing can be done using a laptop, an ADS-B transceiver and a \$5 antenna.

ADS-B experts in the United States, after performing their own tests, agreed with Smith that spoofing is indeed possible with the new technology. FAA, being aware of such a possibility, are putting the pressure on the bidders for ground stations, which should be able to show their system’s anti-spoofing ability.

Although ADS-B is seen to be less expensive than radar, airline and aviation companies still think that the new technology is not worth the amount they’re going to spend to replace existing systems and are holding off buying until the prices drop (Evans, 2006).

However, the prices are not likely to go down until there is a greater demand for the technology. ADS-B Program Manager Vincent Capezzuto said that if consumers are not willing to make any investment risks, it will be difficult to

follow airspace mandates and delays in the benefits offered by the program could be delayed.

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Evans (2006) also tackled the danger of completely relying on GPS for aircraft navigation and surveillance. FAA acknowledges that GPS may be prone to interference and of course, failure. When such a situation arises, an ADS-B - equipped aircraft will have no means by which to obtain air traffic information. It is therefore critical to come up with a backup system.

The Implication of ADS-B in the Aviation Industry

ADS-B can be considered a milestone in the aviation industry. Never before has there been a technology that can provide so much air traffic information and a lot of other features with just a single equipment. With the large volume of passengers and greater air traffic expected by FAA in the coming years, ADS-B seems to be a viable (if not the most) answer to this issue.