Connections
Transport & ICT

Low-Cost Technology to Improve Aviation Safety and Efficiency

Investment program brings modernized aviation information technology to Pacific islands

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The World Bank's Pacific Aviation Investment Program (PAIP) is bringing state-of-the-art air traffic management and satellite-based ground communications to airports and small aircraft operators in seven Pacific island countries and territories.[1] These advances, coming online in 2017, will vastly improve the safety and efficiency of South Pacific aviation and further its global integration. The air traffic surveillance equipment, known as ADS-B, surpasses the abilities of radar to locate aircraft en route and does so at one-tenth the cost.[2] ADS-B increases the safety of flying and improves search and rescue operations; it also enables more efficient flight routing, which saves fuel and reduces greenhouse gases. The installation of the surveillance equipment at ground stations in five Pacific island countries—Kiribati, Samoa, Tonga, Tuvalu, and Vanuatu— and in smaller aircraft will significantly broaden the coverage of aviation activity across the region.

90%

Equipment cost reduction from installing advanced air traffic surveillance technology instead of radar

A new satellite-based ground-to-ground communications network will link those five countries plus Cook Islands and Niue. The network will be resistant to natural disasters, thus improving emergency preparedness and response. More broadly, strengthening aviation-related communications in the Pacific will help integrate the Asia-Pacific region with global developments in air traffic information systems.

Enabling Surveillance of Aircraft En Route

After the disappearance of Malaysian Airways flight MH370 in 2014, many were surprised to learn that air traffic surveillance is unavailable for more than two-thirds of the world's surface, an area that includes much of the Pacific islands region. The reason for the lack of coverage is that deploying radar, the conventional method for tracking aircraft, is too costly for developing countries, including the small island states of the Pacific.[3]

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[1] PAIP is also helping Pacific island aviation improve environmental sustainability in the design of air terminals, runway lighting and paving, and solid waste management (see *Connections* Note #5, 2015).

[2] The cost of ADS-B (Automatic Dependent Surveillance–Broadcast) over the full project area (eight times the size of Germany) compared with the cost if radar had been used—a savings of $50 million.

[3] In the United States, one radar station can cost more than $6 million (ATC Global, www.key.aero/central/attachments/ADS-B_feature_-_Market_Intelligence_Report_I.pdf).

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Even where deployed, radar data is not as accurate or informative as the information available through newer technologies. For example, radar requires from 3 to 15 seconds to update an aircraft's position,[4] leaving a considerable gap in surveillance given that jetliners cover up to 1 kilometer in less than 4 seconds.

ADS-B has a number of key advantages over radar:

• Its positioning data is more precise. A transponder on the aircraft receives the plane's global positioning system (GPS) coordinates and sends the data nearly every second to ADS-B ground stations, which in turn relay it to air traffic controllers.

• It shows a richer set of data. The ADS-B system shows pilots and controllers the plane's absolute location as well as its position relative to other aircraft and weather conditions. The result is greater situational awareness shared by controllers and pilots and a crucial see-and-avoid capability that radar cannot provide. And the more accurate location information allows rescue missions to find crash sites much more quickly.

• It is far less expensive to buy, install, and maintain. Eight competitively procured ADS-B ground stations for the five countries cost about $100,000 apiece. In addition, PAIP will be installing ADS-B units on 55–60 aircraft at a cost of $6,000–$13,000 each.

• It helps optimize flight paths in real time, which reduces aviation CO_2 emissions even more than gains in engine efficiency or aerodynamics. ADS-B optimizes routing by improving the ability of controllers to specify fuel-efficient altitudes and maintain optimal flight direction. It also allows a safe tightening of distance between aircraft, which reduces flight time.[5]

ADS-B is the leading new aircraft surveillance technology and is gradually being installed worldwide as part of the International Civil Aviation Organization (ICAO) Global Air Navigation Plan (2013–28). Many countries are making ADS-B mandatory.

Connecting Air Traffic Controllers

Reliable ground communications are also critical to safe and efficient air travel. Air traffic officials at most airports in the Pacific communicate with each other on conventional land-line or mobile telephones. At a cost of up to $350,000 per installation, PAIP will establish a secure, satellite-based VSAT (Very Small Aperture Terminal) system in the aforementioned five countries, plus Cook Islands and Niue, with a hub managed by Airways New Zealand. The disaster-resilient system will be more reliable and provide a back-up communication network for rapid response in emergencies. The design of the system allows for future expansion.

The Big Picture

Investments in ADS-B and VSAT will transform surveillance and communications across the entire South Pacific. VSAT can be integrated with ADS-B to better exchange aviation surveillance data throughout the region and improve emergency responses. PAIP also complements an ICAO initiative to connect the Asia-Pacific region that will ultimately allow the global exchange of high-quality air traffic information.

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[4]   U.S. Federal Aviation Administration, www.faa.gov/nextgen/equipadsb/benefits.

[5]   For example, U.S. regulators have reported that use of ADS-B over the Gulf of Mexico, where radar coverage is largely absent, saved up to 100 nautical miles on some routes. That in turn saved about 588 kg of fuel (authors' estimate based on fuel burn rate of a twin-jet, narrow-body, single-aisle, short- to medium-haul aircraft), and saved three times that weight in CO_2 emissions.

▶ For more information on this topic:

U.S. Federal Aviation Administration, "NextGEN: Automatic Dependent Surveillance-Broadcast (ADS-B)," www.faa.gov/nextgen/programs/adsb.