Chapter 10
Next Generation Surveillance Technology for Airport and ATC Operations

Werner Langhans
ERA a.s., Czech Republic

Tim Quilter
ERA a.s., Czech Republic

ABSTRACT

Even during the economic crisis, air traffic demand has continued to increase in certain areas of the world, such as the Middle East. Other regions are on their way to recover to pre-crisis traffic demands and will shortly be back to previous growth rates. Airport operators and air traffic control service providers face the challenge to handle this traffic in an expeditious, environmentally friendly, and safe way without generating delays.

Conventional ATC concepts in many parts of the world need to be augmented with next generation surveillance technology, in order to keep pace with the required level of safety in those regions. Conventional technologies, such as primary radar and secondary radar, are not able to deliver the required cost-performance ratios for these increasing demands and need to be replaced by multilateration and ADS-B surveillance techniques. This chapter outlines the recent achievements in worldwide operational deployments in the fields of ADS-B and multilateration for airport and air traffic control applications and discusses the integration into larger aviation system applications.

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INTRODUCTION

Current air traffic control systems have severe limitations and are under economic pressure based on current and future traffic demand. In particular, existing radar-based surveillance infrastructures, which stem from the 1950s, do not have the potential to contribute to more efficient, more expeditious, more environmentally friendly and safer air transport systems. Operational concepts throughout the world (ICAO, NextGen and SESAR) have already identified the need for a next generation surveillance technique with more demanding operational requirements, due to the higher density of air traffic expected. The multilateration technique (MLAT) and Automatic Dependant Surveillance (ADS-B) have started to replace Secondary Surveillance Radars (SSR), and more and more air navigation service providers are using this next generation technology. Huge life-cycle cost savings and operational improvements are expected to be achieved using these next generation surveillance techniques throughout the world, which will help foster future worldwide economic growth.

THE ECONOMIC AND TECHNICAL ENVIRONMENT FOR NEXT GENERATION SURVEILLANCE

The Historical Driver for Next Generation Surveillance

In the late 1990’s, air traffic control systems in the United States and Western Europe began seeing more and more delays. For the first time, EUROCONTROL reported average delays of more than 15 minutes per flight. At that time, slow turning radar technology with update rates up to 12 seconds, some of which were 15-20 years old, together with old and isolated data processing systems, were commonly used around the globe. ATC system procedures simply could not cope with the huge traffic demand created by the liberalization of the airline industry and the prosperous global economy.

The Dawn of Multilateration

Since the beginning of the last century, there have been many external forces that have greatly affected the economics of the aviation industry. We have seen the airline industry change dramatically, by mergers and bankruptcy; we have seen aircraft manufacturers merge into only 2 major companies; and we have seen air navigation service providers (ANSPs) strive for improved efficiency and increased productivity.

One major way that ANSPs have looked to balance the steadily increasing demand in air traffic with the increasing safety demands and lower costs is to look to next generation air traffic management technology. They found that technologies, such as Mode S MSSR radar with higher update rates (4-8s), multilateration for airport and wide area surveillance and multilateration for height monitoring units could serve as significant tools to help them achieve their ambitious goals.

The Pioneers of Multilateration

In the early 2000’s, two ANSPs emerged as surveillance pioneers, and began replacing their radars with multilateration technology. The Czech Republic and the Austrian ANSPs were the first to deploy wide area multilateration (WAM) systems instead of radar technology. Ostrava in the Czech Republic (2003) and Innsbruck in Austria (2004) were such great successes, in terms of technical and economical performance, that a whole group of ANSPs in Europe and even the FAA started to look into this new substitute technology. Lifecycle cost savings for Innsbruck have been calculated at about 13M Euro (W. Langhans, Ch. Scheiflinger, et.al., 2007), when compared to MSSR, which would have required two systems to adequately