Chapter 13
Collaborative Decision Making and Information Sharing for Air Traffic Management Operations

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ABSTRACT
One of the most notable concepts related to the future cooperative Air Traffic Management (ATM) is the Collaborative Decision Making (CDM). This new management philosophy of using collaborative technologies and procedures to enable ATM partners drives efforts towards the common goals of sharing and exchanging information. To support the implementation of CDM, a likely solution was found in the context of System of Systems (SoS), system integration, and interoperability. Service-Oriented Architecture (SOA) principles and technologies were recognized as one of the best alternatives to allow this implementation. Within this architecture, the System Wide Information Management (SWIM) has been developed on the last decade, and SWIM applications will be accessible to all ATM partners on the next decade by providing full airspace information, updated in real-time by all involved partners. This chapter presents an overview of key elements in information sharing for ATM and explains how SOA, SWIM, Aeronautical Information Management (AIM) and CDM support each other development.

INTRODUCTION
As a complex global system, the Air Transportation comprises many public and private partners. Today’s Air Traffic Management (ATM) is reaching its capacity limits. This means it will not be able to sustain demands already in a near future. On this context, some problems need attention and solution, such as the following presented by the European
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- Inefficient use of available airport and airspace capacity;
- Awareness lack of airspace real-time status;
- Limited coordination between Airspace Management Cells (AMC), Flight Management Positions (FMP), and Central Flow Management Unit (CFMU);
- Limited information sharing between Air Traffic Control (ATC), Aircraft Operators, CFMU, Ground Handlers, and Airport Operators;
- Different demands from predicted and actual traffic flow;
- Static route structure and lack of flexibility in use of airspace; and
- Limited interface between airports and the air network.

An alternative way of addressing these issues is to apply the Collaborative Decision Making (CDM) by using collaborative technologies and procedures to get benefits associated with flight and strategic planning.

Applications of CDM and information sharing represent two key elements for the future cooperative ATM concept. They are enabled by the Information Management and Services principle which deals with: logistics of Information Management; information sharing in a scattered environment of information suppliers; and consumers allowing the ATM community to conduct its business in a safe and efficient manner.

Within the ATM Operational Concept, the application of CDM aims to improve Air Traffic Flow and Capacity Management (ATFCM) in the airport and airspace context.

Therefore, this chapter aims to present information about concepts and technologies supporting the CDM functionalities development such as System Wide Information Management (SWIM).

The Service-Oriented Architecture (SOA) is considered as the basis for SWIM. Behind it is the concept of Software as a Service (SaaS) from where the main ideas of software functionality disclosures including information retrieval, computation, and storage came from. Then, in order to become more effective SaaS needs SOA.

SWIM is still being developed. It is a concept on which current ATM software systems will be adapted and new ones will be developed accordingly, becoming the so-called SWIM-enabled software applications.

Therefore, considering ATM scenarios, this chapter focuses only on Airport CDM, SOA, Aeronautical Information Management (AIM) and SWIM. At the end, it tackles some future research directions, trends and perspectives, and conclusions.

BACKGROUND

As stated by (Ky & Miaillier, 2006), air transportation is considered a global industry. Europe and the USA, the two densest air traffic regions, face the same challenges for transforming their ATM systems.

In Europe, the EUROCONTROL through the Single European Sky ATM Research (SESAR) program aims to significantly increase safety, security, capacity, efficiency, and environmental compatibility of air transportation. This is to be done to restructure European airspace, adjust air traffic flow, create extra capacity, and increase the overall efficiency of the European ATM system. In USA, the Federal Aviation Administration (FAA) through the Next Generation Air Transportation System (NextGen) program aims the same. They both represent ATFCM modernization initiatives around the world looking for more effective ways of using the Air Transportation system thus improving the air safety.

NextGen and SESAR are similar initiatives which have been coordinated to make sure that
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