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Air Traffic Services and Airspace Management

空中交通服务与空域管理

甄 陆 编著

中国民航出版社

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甄 陆 编著

责任编辑	杨玉芹 罗仁君
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前　言

民航运输业的高速发展需要既精通英语又懂民航专业知识的复合型外语人才，建立具有民航特色的英语教学课程体系是为民航培养合格外语人才的基本保障。根据课程体系要求，我们编写了《空中交通服务与空域管理》（Air Traffic Services and Airspace Management）教材，此教材为新世纪民航专业英语系列教材之一。

本教材内容翔实、广泛，不仅涉及国际民航组织有关空中规则与空中交通服务的国际标准和建议措施，美国联邦航空局（FAA）及欧洲航空安全组织（EUROCONTROL）有关空域划分和灵活使用空域（FUA）的具体要求和规定，还包括与提供空中交通服务有关的背景知识。本教材主要内容如下：第一部分为空域管理，包括空域介绍、空域划分及灵活使用空域；第二部分为空中规则，包括一般规则、目视飞行规则、仪表飞行规则及信号；第三部分为空中交通服务，包括空中交通服务总则、空中交通管制服务、飞行情报服务及告警服务。

本教材的主要部分曾作为讲义在实际教学中使用多年，比较好地满足了学生学习需求，对教学目标的实现起到了重要的保障作用。为使其更加完善，在成书过程中征求了多位业内专家和中国民航大学英语专业多届学生的意见，进行了多方面的补充和修订。本教材具有以下特点：

1. 编排合理，循序渐进：先介绍空域管理和空中规则，使读者在了解空域和空中规则的基础上更容易理解国际民航组织有关空中交通服务的标准和建议措施。

2. 语言规范，通顺流畅：本教材所有课文及课外阅读材料（Reading for Knowledge）均选自国际民航组织文献及国外最新原版教材，语言规范、地道、流畅，便于读者以英语为媒介学习相关民航专业知识，扩充民航专业词汇，并了解国际民航组织文献的文体特征。

3. 互为补充，相得益彰：本教材的每个单元均配有课文和课外阅读材料，两部分的内容密切相关。通过学习课文，读者可以了解一般性的民航专业知识；而通过学习课外阅读材料，读者可以扩充相关知识，并加深和巩固课文所涉及的知识点。

4. 体例完备，使用方便：为便于课堂教学和读者自学，本教材在每个单元具体内容的设计与编排上力求人性化，每个单元都设计了带中文注解的英文摘要（Synopsis）、学习重点（Checkpoints）、课文（Text）、单词（New Words）、词组（Phrases and Expressions）、专业名词解释（Definitions）、带语法解析和中文翻译的疑难句注解

（Notes）、练习（Exercises）以及与课文内容相关的课外阅读材料（Reading for Knowledge）共九个部分的内容。

本教材的所有课文和课外阅读材料均选材于国际民航组织文献原文和国外英文原版教材，适合具有中等以上英文水平的读者使用。除供英语专业本科生及硕士研究生使用之外，本教材也可作为非英语专业本科生及硕士研究生的辅助教材。

本教材在编写过程中得到了中国民航大学杨虎、于剑等校领导的大力支持，也得到了空中交通管理学院、国际飞行学院、国际处等单位的杨新涅、戴福青、张炳祥、庆峰、王武民、闫少华等领导和教授的悉心指导，还得到了外国语学院朱敬才、赵宁、张艳玲、杨铭、罗旭、易翔、邢蓝月等同仁的热情帮助，特别是朱敬才教授在此书的编写过程中给编者提出很多宝贵的和富有建设性的建议，编者在此表示衷心的感谢。

本教材在编写过程中参考了大量书籍和电子资料，为避免繁复，书中不再分别列出，仅在书后列出主要参考目录，以便读者检索。在此，编者向所有被引用的书刊和资料的作者致以诚挚的谢意。

由于编者水平有限，在编写过程中难免存在一些错误和不妥之处，恳请专家和读者批评指正。

甄　陆

2015 年 10 月

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Part 1 Airspace Management

Unit 1 Introduction to Airspace

Synopsis

Like territorial land and territorial waters, the airspace of a country is also considered as a kind of important national resource of this country. Since airspace is different from land and waters, the utilization of airspace is also different from the utilizations of land and waters.

In order to meet the needs of national security, facilitate both airspace management and the provision of air traffic services, optimize airspace structures, maximize the benefits of the users and allow airspace to be utilized in a more economic, efficient, orderly and safer way, the airspace of a country is usually divided into different types and classified into different classes.

This unit provides readers with some basic concepts and methods of how the airspace of a country is usually divided and classified through the following topics:

Airspace types (空域类型)

- Flight information region (飞行情报区): Flight information region, FIR in short, is normally the largest regular division of airspace in use in the world today, in which flight information service and alerting service are provided.
- Controlled airspace (管制空域): ICAO defines controlled airspace as the airspace of defined dimensions within which air traffic control service is provided to IFR flights and to VFR flights in accordance with the airspace classification.
- Uncontrolled airspace (非管制空域): Uncontrolled airspace is airspace where an air traffic control service is not deemed necessary or is not provided for practical reasons. It is the opposite of controlled airspace.
- Advisory airspace (咨询空域): An advisory airspace is referred as the airspace of transition from an uncontrolled airspace or flight information region to a controlled airspace, within which air traffic advisory service is available.
- Special use airspace (特殊使用空域): According to the needs of national secur-

ity and defense, different countries in the world may have different requirements on special use airspace. Generally, special use airspace includes: prohibited area (禁飞区), restricted area (限制区), temporary flight restriction (临时飞行限制区), air defense identification zone (防空识别区), warning area (警告区), military operations area (军事活动区), alert area (告警区), controlled firing area (射击控制区), national security area (国家安全区).

Airspace classification

- The airspace classification of ICAO: Class A Airspace, Class B Airspace, Class C Airspace, Class D Airspace, Class E Airspace, Class F Airspace and Class G Airspace. Class A, B, C, D, E are controlled airspaces and Class F and G are uncontrolled airspaces.
- The airspace classification of the United States: Class A Airspace, Class B Airspace, Class C Airspace, Class D Airspace, Class E Airspace and Class G Airspace. Class A, B, C, D, E are controlled airspaces and G is uncontrolled airspace.
- The airspace classification of China: Class A Airspace, Class B Airspace, Class C Airspace and Class D Airspace, and they are all controlled airspaces.

Checkpoints

After studying this unit, you should be able to understand:

1. the basic division of airspace types;
2. the IFR VFR flights in controlled airspace;
3. the IFR VFR flights in uncontrolled airspace;
4. the sub-division of special use airspace;
5. the airspace classification of ICAO;
6. the airspace classification of the United States;
7. the airspace classification of China.

Text

Airspace is the portion of the atmosphere controlled by a country above its territory, including its territorial waters or, more generally, any specific three-dimensional portion of

the atmosphere. It is not the same as aerospace, which is the general term for Earth's atmosphere and the outer space in its vicinity.

Like territory and sea areas, airspace is also a kind of national resources. In order to make better and more efficient use of airspace and make it accommodate flows of all traffic in a safe and economic manner, the airspace needs to be planned and managed. The management of airspace should be focused on the process by which airspace options are selected to meet the needs of its users. Airspace management can be considered as a planning function with the primary target focusing on maximizing the utilization of the available airspace whilst maintaining the level of safety applicable to air traffic operations within such airspace. [1]

The management of airspace should follow the following principles and strategies:

a) Airspace should be managed by way of FUA concept;

b) Airspace should be managed to accommodate the dynamic flight trajectories and provide optimum operational solutions;

c) Airspace should be managed to minimize the impact of operations when conditions require different types of traffic to be segregated by airspace organization in terms of the size, shape and time;

d) Airspace should be managed through coordination to accommodate the conflicting requirements of all users and to minimize all operational constraints as well;

e) Airspace should be managed to accommodate the reservations planned in advance with changes made dramatically whenever possible.

1 Airspace Type

In order to facilitate airspace management and be in accordance with the utilization purposes and national security, the airspace of a country is normally divided into different types, such as flight information region, controlled airspace, uncontrolled airspace, advisory airspace, special use airspace and so on. [2]

1.1 Flight Information Region

FIR is normally the largest regular division of airspace in use in the world today. ICAO defines flight information region as an airspace of defined dimensions within which flight information service and alerting service are provided.

Most of countries divide the airspace under their jurisdiction into several flight infor-

mation regions. In order to facilitate the administration and the service provision, there is no standard size for a specific flight information region. The flight information regions over high seas are divided in accordance with ICAO Regional Air Navigation Agreements, and the contracting states of ICAO assume the responsibility to provide the service. Some flight information regions encompass the territorial airspace of several countries. Unlike ADIZ, the service provided in a flight information region mainly focuses on air traffic control and flight information. The flight information service and alerting service are provided by appropriate air traffic control units, including the current air traffic conditions, the special air traffic conditions and weather conditions, especially the adverse weather and severe weather conditions.

Today, in China there are eleven flight information regions, which are mainly responsible for providing the air traffic control service and flight information service to the traffic operating in the airspace of China.

1.2 Controlled Airspace

Generally speaking, a controlled airspace is airspace of defined dimensions within which ATC services are provided, in other words, the flight of any aircraft shall be subject to air traffic control. [3] However, because of the different classes of airspace, the level of control may vary in different classes. Controlled airspace usually imposes higher weather minimums than uncontrolled airspace. It is the opposite of uncontrolled airspace.

ICAO defines controlled airspace as the airspace of defined dimensions within which air traffic control service is provided to IFR flights and to VFR flights in accordance with the airspace classification. Controlled airspace is established mainly for the following three reasons:

a) high-volume air traffic areas, e. g. near airports;

b) IFR traffic under ATC guidance;

c) security.

Controlled airspace usually exists in the immediate vicinity of busier airports, where aircraft used in commercial air transport flights are climbing out from or making an approach to the airport, or at higher levels where air transport flights would tend to cruise. [4] Some countries also provide controlled airspace almost generally, but in most countries it is common to provide uncontrolled airspace in areas where significant air transport or military activity is not expected.

As far as ICAO airspace classification is concerned, Class A to Class E are referred to

as controlled airspace. Flight under instrument flight rules (IFR) is allowed in all controlled airspace and some countries also permit IFR in uncontrolled airspace; flight under visual flight rules (VFR) is permitted in all airspace except class A. However, different countries may have different airspace classifications because of national security and local conditions. For example, today, the whole airspace above China is controlled airspace. In the United States, the controlled airspace is further categorized into positive controlled airspace (PCA) and controlled airspace.

Within positive controlled airspace, ATC separates all aircraft, whether IFR or VFR, and the FAA either absolutely prohibits VFR flight operations, or if permitted, separates both VFR and IFR aircraft. PCA is reserved for either very high-altitude flights at or above 18,000 feet mean sea level (MSL) or around high-density airports.

Within controlled airspace, ATC separation services are provided to IFR aircraft. IFR aircraft are authorized to fly into clouds or areas of reduced visibility and are provided ATC assistance to remain separated from other IFR aircraft. IFR aircraft, when operating in areas where weather conditions and traffic density permit other aircraft to be safely observed and avoided, are still responsible for separating themselves from VFR aircraft. VFR aircraft operating in controlled airspace are also responsible for separating themselves from all other aircraft. VFR flight operations are permitted so long as the weather conditions are sufficient to enable pilots to "see and avoid" other aircraft.

1.3 Uncontrolled Airspace

Uncontrolled airspace is airspace where an Air Traffic Control (ATC) service is not deemed necessary or cannot be provided for practical reasons. It is the opposite of controlled airspace.

According to ICAO airspace classification, Class F and Class G are referred to as uncontrolled airspace. As it is mentioned above, there is no uncontrolled airspace in China right now. In the United States, Class G is referred to as uncontrolled airspace.

Class G airspace in the United States extends from the surface to either 700 or 1,200 feet AGL (Above Ground Level) depending on the floor of the overlying Class E. In the vicinity of an uncontrolled airport, the common traffic advisory frequency (CTAF) for that airport is used for radio communication among pilots. In remote areas, other frequencies such as MULTICOM are used. No towers or in-flight control services are provided although communications may be established with flight service stations which are not part of the NAS.

IFR flight without ATC clearance is permitted to fly in the uncontrolled airspace, provided that pilots are instrument-rated and the aircraft are equipped for instrument flights.[5]

ATC does not exercise any executive authority in uncontrolled airspace, but may provide basic information services to aircraft in radio contact. Flight in uncontrolled airspace will typically be under VFR. Aircraft operating under IFR should not expect separation from other traffic, but in certain uncontrolled airspace, this might be provided on an "as far as is practical" advisory basis. In uncontrolled airspace, ATC separation services are not provided. Whether IFR or VFR, all aircraft must provide their own separation, regardless of the weather conditions, unless an emergency exists. Additional ATC services can be provided, however, on a workload-permitting basis. If a controller finds it necessary to issue a clearance to an aircraft while it is still within uncontrolled airspace, the Air Traffic Control Handbook suggests that the following phraseology be used to ensure that the pilot is aware that ATC services will not begin until the aircraft enters controlled airspace:[6]

"N512PU, upon entering controlled airspace, fly heading two seven zero and join victor two fifty-one."

1.4 Advisory Airspace

ICAO defines an advisory airspace as the airspace of defined dimensions, or designated route, within which air traffic advisory service is available. Today, in China there is no establishment of advisory airspace.

An advisory airspace can be referred to as the airspace of transition from an uncontrolled airspace or flight information region to a controlled airspace. An advisory airspace has both temporary and transitional characteristics, and the establishment of advisory airspace is aimed to have a preparation on both personnel and equipments for purpose of providing future air traffic control service.

The purpose of providing advisory service is to make better use of information as to the collisions of aircraft than to provide flight information service only, and it is actually a backup service on collision avoidance to flight information. Advisory service is provided only when air traffic service cannot provide sufficient air traffic control service.

It should be noted that recently, in connection with the problem created by the mixture of IFR and VFR flights around busy aerodromes, some States have instituted an air traffic advisory service to VFR flights which is intended to:[7]

a) keep such flight separated from IFR flights operating in the same area;

b) provide them with advice on the conduct of their flight and on other VFR traffic

operating in their vicinity;

c) provide advice to IFR flights operating in the same area.

Such service is intended to reduce potential risks of collision without the need to impose too restrictive conditions on VFR flights. Should this service become more widespread and thus acknowledged by ICAO, it could change the fundamental concept of the air traffic advisory service.

In the United States, an airport advisory area is 10 statute miles in radius around the airport where a flight service station is located but there is no operating air traffic control tower. Flight service station personnel will offer weather information and traffic reports to arriving and departing aircraft, but will not offer any separation services to aircraft. It is not mandatory that pilots use airport advisory services, but it is highly recommended by the FAA.

1.5 Special Use Airspace

Special use airspace is the designation for airspace in which certain activities must be confined, or where limitations may be imposed on aircraft operations that are not part of those activities. Certain special use airspace areas can create limitations on the mixed use of airspace. The special use airspace depicted on instrument charts includes the area name or number, effective altitude, time and weather conditions of operation, the controlling agency, and the chart panel location. [8]

Different countries may have different requirements on special use airspace. The special use airspace in China consists of danger area, restricted area, prohibited area, fuel dumping reserved area and air defense identification zone.

In the United States, the special use airspace is further divided into regulatory special use airspace and non-regulatory special use airspace. Some special use airspace, such as prohibited and restricted areas, are regulatory special use airspaces; other areas, such as warning, military operations, alert, and controlled firing areas, are non-regulatory special use airspaces. Special use airspace can lie within either controlled or uncontrolled airspace and can potentially affect both IFR and VFR aircraft.

1.5.1 Regulatory Special Use Airspace

1.5.1.1 Prohibited areas

A prohibited area is airspace where aircraft operations are absolutely prohibited by law. These areas are directly concerned with either national security or public safety. Among the prohibited areas are the White House, the Capitol Building and Camp David.