VISUAL FLIGHT PROCEDURE DESIGN IN CHINA

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Abstract

Nowadays, the number of airports and the flight volume in China is increasing. At the same time, the number of general airports has steadily increased. For most general airports, visual flight procedures are widely used. However, there are no existing criteria in PANS-OPS or any other documents to support standardization of these procedures and thus provide consistent application.

The aim of this paper is to present a concept of operations for the application of RNAV published visual procedures in general aviation airports in China. Through the agreement of this concept of operations, a standardized design criteria and charting methodology can then be applied and thus remove inconsistencies that currently occur.

1 General Introduction

In order to meet the needs of future air transport development, ICAO proposes the concept of a new generation navigation system (FANS) based on the drawbacks and limitations of the traditional systems used today. FANS is short for Communication, Navigation, Surveillance, and Air Traffic Management (CNS/ATM) systems based on satellite technology, data communication technology, and computer technology. However, navigation technology is one of the main technologies of FANS. Its level of development seriously affects and restricts the safe and efficient operation of flight and control. Therefore, since the end of 2009, the International Civil Aviation Organization (ICAO) has embarked on the implementation of the "Performance-based Navigation (PBN)" navigation technology as a feasible solution for the excessive navigation from land-based navigation to satellite-based navigation. China Civil Aviation also announced the “China PBN Implementation Roadmap”, which identified the plans and guidelines for implementing PBN in China’s civil aviation. According to the plan, China began implementing RNAV operations in some airspace and in some airports. This represents that China’s civil aviation has officially opened the prelude to the implementation of PBN technology. Compared with traditional land-based navigation, the implementation of RNAV technology, the use of radio positioning can determine the specific position of the aircraft or the position of the aircraft relative to the planned route, thus, no matter in actual operation or the requirements of the equipment Fly to or over the relevant navigation station, so that the flexibility of route arrangement can be realized, and each route can be formed by connecting the line segments between each waypoint without a navigation station. On October 28, 2014, the North China Air Traffic Control Bureau took the lead in implementing the airport multi-runway visual approach program at the Capital International Airport, which enabled the pilot to gain initiative in the operation of the aircraft. This is also the first time that a multi-runway visual approach has been implemented in China. Under such circumstances, our country is still lagging behind in the visual specification of visual programming, which has also led to slow progress in visual flight program design in China. Nowadays, the number of airports in China continues to increase, and the number of flights is also increasing. At the same time, the number of general airports has also steadily

increased, but for most of the airports, the nature of the flight is visual flight, but China has not yet observed the relevant specifications of the flight program design. Therefore, this design is also aimed at the current domestic operational status, combining the actual conditions of the relevant airports, visual RNAV flight program design, further exploration of reasonable visual RNAV flight program design specifications, visual chart specification and operating methods.

2 Visual RNAV Flight Procedure Design Criteria

2.1 PBN Task Force European Aviation Safety Organization RAiSG Meeting Specification

On March 5, 2014, ICAO launched a document on the RNAV visual flight.

As far as RNAV visual flight is concerned, so far, from the published specifications, it is required to fly. The crew has visual reference to specific landmarks (including entrances, bays, rivers, and major highways, buildings)And bridges, etc.) And can land on the instructions of these landmarks. In this document, many RNAVs at various airports are listed.

A visual approach map showing the route, airspace and altitude limits, minimum weather requirements, and visual approach indicators Order and so on. It is known from the document that visual approach can use path points to navigate the aircraft and, as a result, Path points instead of signposts. The above concept makes the design of the program more complicated and must be clear at the same time. The use of speed and height at each path point must be designed to avoid noise sensitive areas and reduce environmental Pollution (including noise and the distribution of light and heat). In addition, a uniform flight profile is required for the ATC to The crew sorts the aircraft. For aircraft operators, provided weather conditions permit a more efficient route to the airport. This not only saves time but also reduces fuel consumption.

Today, RNAV visual flight is still special for aircraft operators.

2.2 Criteria from ICAO

In ICAO's doc8168 document, in the fourth chapter of the first part of the third chapter, the specification of omni-directional departure.

In line with the explanation, omni-directional departure is a convenient and flexible way to ensure the clearance of obstacles. There is considerable reference.

The omni-directional departure procedure is based on the aircraft climbing the runway direction above the DER level before starting the turn 75m. When the obstacle clearance requirement reaches an additional height, the straight line departures need to be extended until the required turn height/height is reached. Allows less than the length of the straight line departure 15° turn. When you reach the specified corner height/height, you can join the route segment after turning in any direction.

The omni-directional departure can be divided into different sectors and the height and PDG limits can be specified for each sector, or the Avoid sectors.

2.3 Criteria in the U.S.

FAA Published United States Standard for Terminal Instrument Procedures (TERPS), Volume IV, Chapter IV), Visual climbs and visual observations after leaving the airport during visual flight. The drop point was stipulated.

Visual climbing concept and requirements Visual climb refers to the option of letting the aircraft establish a visual reference to fly over obstacles when it leaves airport for takeoff. The object should be visually separated from the field by selecting the appropriate height in the place where the instrument should be left. For pilots, In the case where the gradient of the departure is not specified, it is possible to select the visual climb to leave the field. When obstacles are at the end of the runway. When the end distance is greater than three miles and a rate of climb greater than 200 ft/NM is required, it must be mandatory.

2.4 Criteria in the China

The 86th Order in China, which is described in Article 154 of the "Civil Aviation Air Traffic Management Regulations of China"
The regulations regarding visual landing routes. Different regulations have also been made for aircraft that are up and down.
(1) Flight between the day and day
The altitude of a flight route is usually 300m to 500m (small routes at low altitude shall not be less than 120m).After take-off, the height of the first turn and the end of the fourth turn must not be less than 100m.
The ups and downs flight is usually left. Subject to conditions, it may also be specified as a right route;
Do not exceed the same type of aircraft when flying on the rising and landing routes;
The addition of aircraft to the launching and landing route shall be subject to the permission of the controller of the control tower of the tower and shall be in accordance with the prescribed height. Join along the route. In the daytime, the number of aircraft flying at the same time on the rising and landing routes should be based on the locations of airports. Shape, ground equipment and other conditions are determined. From the tower or takeoff line tower, all aircraft on the route can be seen No more than 4 aircraft; no visible aircraft on certain segments of the landing route may not exceed 3 aircraft; Category C and D Aircraft must not fly more than two aircraft or low-altitude air routes.
(2) Night-time landing route flight
The aircraft pilot can aim at the aircraft in the range of the up and down routes or in the range of adding and detaching from the ups and downs. Depending on the airport and ground lighting, the aircraft may be allowed to do a night-time landing and flight route and comply with the following regulations:
(1) The altitude of a flight route is usually 300m to 500m. After taking off, begin the first turn and end
The height of the fourth turn must not be less than 150m;
(2) Do not exceed the preceding aircraft during flight of the rising and landing routes;
(3) The aircraft shall enter the landing and take-off routes and shall enter the market in accordance with the instrument flight rules, using the airport lighting and navigation facilities. Prepare the exact position and, with the permission of the control of the tower controller, join the route according to the regulations;
(4) The number of aircraft flying at the same time on the rising and landing routes must not exceed two aircraft.

2.5 Criteria in the UK

In the Guide to the visual flight (VFR) in the UK, the specification of the British visual flight is carried out.
(1) Speed limit
In the airspace below FL100, a 250 kW airspace speed limit is applied, but when in the program or ATC there are other When specified, the speed limit may be reduced.
(2) Flight Plan Requirements
With the exception of category E airspace, flights are required for all controlled airspace flights. In some cases, flying Program requirements may be met by passing flight details through RTF. The flight plan includes enough information to make ATC The unit is able to issue regulatory controls for search and rescue (Article 29 of the UK Air Navigation Directive).
(3) ATC license and ATC directive
Except for Category E airspace, all controlled airspace flights require air traffic control permits and must comply with Keep the ATC instruction. In class E controlled airspace, pilots performing visual flights must have appropriate air traffic control. The unit made contact and complied with the ATC directive. In non-controlled airspace, receive services from air traffic service units. The aircraft in question shall comply with air traffic regulations unless otherwise instructed by the pilot.
(e) Others
In addition to the above provisions, it is also responsible for visual ATC duties in flight, higher than FL195 in Class C airspace. Visual flight rules, visual flight authorized by the air traffic control authority in Class C airspace, airport control zones, The military control zone and other areas have made specific provisions.

2.6 European Standard Air Rules - Work Equipment Update Specification

Introducing the Standardized European Rules of the Air (SERA) – UK Implementation Update
A number of visual flies were made under different conditions, and all of the special couples were restrained.
(1) Prescribed items
There are provisions for the visual flight of gliders and parachutes in A airspace.
Visual weather conditions in the airspace of C, D, E
Special Visual Flight of Control Zones
Minimum visibility of visual weather conditions, and minimum horizontal vertical distance from clouds
Provisions for night-time, visual flight and special visual flight
Visual cruising altitude regulations
About special visual flight and route that has been notified
(2) Matters needing attention
For obedience to the subparagraph (b), the CAA is allowed in the paragraphs SERA.3105, When operating under the SERA.5005(c) and SERA. 5005(f) rules, the aircraft is high when flying below 1000 ft.
The height of the highest obstacle in the area, in the urban congestion zone, with the aircraft as the center, 600m radius
Within a circular range, towns, settlements or rendezvous points must meet the following conditions during day and night operations:
The special visual flight method to be adopted, which will be operated in accordance with the notified procedure.
Unless the CAA has obtained permission, the landing can only be obtained in a country under the condition of permission.
The home's airport, EASA documented airport, or government's airport is operated by aircraft.
Minimum visibility of visual weather conditions and minimum horizontal and vertical distance gauges from the cloud set.
Under paragraph SERA.5001 rules, in G airspace, CAA permits reduced visibility of flight to no less than 1500m; it can meet the following conditions.
First, the aircraft is operating at 3000 ft (inclusive) with reference to the mean sea level; flight instructions Airspeed remains at 140kt and below in order to give aircraft sufficient time to observe other aircraft and obstacles Things to avoid conflicts.
Using the appropriate editor each equation should occur on a new line with uniform spacing from adjacent text as indicated in this template. The equations, where they are referred to in the text, should be numbered sequentially and their identifier enclosed in parenthesis, right justified. The symbols, where referred to in the text, should be italicized.

3 Visual flight procedure criteria application

3.1 Visual RNAV Approach Procedure Design

By reference to the meeting document of ICAO EUR PBN TF & EUROCONTROL RAiSG

From the viewpoint of visual flight program design, two methods of visual flight program design were extracted:

a) Drawing according to the visual mobility principle using the specified track;

b) The implementation needs to meet the following two conditions: first, it must be run under the RNAV specification, and secondly,

As the relevant documents are not yet complete, it is necessary to wait for the update of the meeting documents or related regulations and regulations and to set up the door's workbooks make it easy to follow-up operations and can also be used temporarily or permanently.

In the actual design of the flight program, it is necessary to consider the appropriate waypoints in conjunction with RNAV capabilities. Related height options and limited speed.

In designing, there are two other things to note:

a) At the beginning of the visual RNAV visual approach procedure design, it is important to determine the altitude data. And in

At a higher height limit, the above height is the minimum height, which also prevents the

approach from starting too late or high adverse effects.

b) Between the final approach fix and the Mapt point, it must be ensured that there is a length of the segment, and its height data is

500ft above the runway entry point height.

After completing the route design, the flight program will be determined, the chart will be drawn, and the database will be stored and run.

In the flight program determination stage, the storage and use of route information needs to be confirmed, visually approaching the point of decline Starting from the final approach fix or approach fix in the approach graph, the core of the inquiry is to store this information.

The method of depositing in an established database, at the same time clarifying what appropriate way the advance selection will take place. Due to Differences in the operational capabilities of various types of aircraft, not all types of aircraft have the above capabilities to perform secondary flights Draw. During the drawing phase of the aeronautical chart, appropriate measures should be taken to record discontinuous flight information data. RNAV Visual flight may not have a go-around procedure. Therefore, it should be determined if a go-around procedure is required and Determine the necessary information that should be stored in the database. Due to system and operational requirements, the above operations will also be the cloth became part of all published information in the chart. Also note that the minimum weather conditions must be determined. Minimum cloud height, appropriate level visibility, data The general applicability or local applicability of the airport, the necessity of visual inspection at the airport, the visual distance from obstacles and With sufficient visual references, all of the above listed factors should be carefully considered and determined. Need to mention The name of the chart should be determined in advance according to the coding and operating capabilities.

3.2 Visual Departure Procedure Design

The papers in the reference list must be cited in the text. In the text the citation should appear in

Design reference for departure procedures FAA's United States Standard for Terminal Instrument Procedures (TERPS).

Before drawing, you first need to master the concept of ICA, namely initial climb area, and then use VCOA (visual (climate over airport) concept drawing, after interpretation of relevant content, this concept is the Airspace Planning Division In the area of the turn in the process, in this document, the scope of the initial climb area must be included in the protection of the VCOA. Area. For visual flight program design, the document describes two methods: the first is to complete the visual flight of the initial phase and then to make the flight of the specified track; the second is to fly to the waypoint after completing the visual climb. Considering comprehensively, the method of flying to the waypoint after completing the visual climb was selected. Under normal circumstances, if the climb rate is higher than 00ft/NM, the obstruction will be 3 miles away from the end of the runway. In this case, a visual climb will be required to leave.

This article design method considers several points:

a) The first step is to specify the height of the highest obstruction around the airport, and determine the height to which it should climb based on the height of the obstacle.

b) The second step is to determine the radius of the protected area left by visual climb, based on the climbed altitude and aircraft speed

c) The third step is to visually climb any point in the departure protection area as the first point of the nominal track, and take the waypoint as the second point (in the round outside the protection area, the connection to the protection of the way point District, the protected area that climbs visually)

d) Calculate whether the barrier on the nominal track penetrates the obstacle assessment surface or not

For the height selection of visual climbs and the evaluation of surrounding obstacles, the specification takes a 40:1 face. If there are obstacles penetrating the face, there are two solutions for reference: the first is to choose another one. More appropriate climbing height to avoid the obstacles through the assessment of

the surface; the second is to increase the aircraft climb rate, improve the safety of the aircraft route operations; of course, when all aspects of demanding, you can adjust the climbing height also increased large aircraft climb rate. There are two points that should be noticed in published charts: The first is to specify the altitude, subsequent route information and altitude information when flying over any route point; the second is to publish the information according to the table framework when publishing information about the cloud and visibility.

4 Conclusion

This article collects and collates domestic and foreign specifications and conference documents related to visual flight, selects corresponding specifications, and conducts design studies on the visual approach, visual approach, and visual departure procedures for specific airports. Nominal track, protected area, obstacle assessment at the same time, finally announced the operating standards and visual aeronautical charts. In the design, combined with the airport's topographic conditions, facilities and equipment conditions and operating capabilities, the navigation procedure specification RNP APCH for the approach procedure and the navigation specification RNAV1 for the departure procedure were determined. The final track and standards meet operational requirements. The design is mainly divided into three parts. The first is to collect and sort out the research background and significance of visual RNAV, and to analyze and explain the research status of this section at home and abroad; then to ICAO, FAA, The European (especially the United Kingdom) and China’s regulations on visual RNAV flights have systematically studied and collated; finally, they are aimed at specific airports, combined with the airport’s meteorological conditions, terrain conditions, and operational capabilities, and apply the collated specifications. The flight program was designed.

3.3.2 Example

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