



- Agenda Item 4:** ATM Automation System implementation by States  
4.2 Systems operations management and maintenance practices

**RADAR ACCESS RISKS AND SOLUTIONS TO ACC****ATM AUTOMATION SYSTEM**

(Present by China)

**SUMMARY**

This paper introduces the risks happening in the ATM automation system while importing radars, and summarizes the prevention and safeguard of it.

**1. BACKGROUND INTRODUCTION**

1.1. In the current situation, China has built seven Area Control Centers all over the country. It is indispensable to import local radars in addition to ones in other regions. On one hand, given the various characteristics of airspace, it decides in favor of surveillance coverage reinforcement with different priority weighting. On the other hand, it is conducive to effective compensation for the margin adjacent to regions.

1.2. Taking Chengdu ACC for example, the airspace controlled by the Chengdu ACC consists of the vertical airspace of Sichuan, the upper airspace of Chongqing, and the upper airspace of Guiyang. At present, Chengdu ACC has been access to 29 radars, 5 of which is from Sichuan airspace, 13 of which belongs to Chongqing and Guiyang and the rest of which is part of other adjoining regions.

1.3. Although more and more radars access enhances the multiple coverage of the airway and reduces the blind zone of coverage, it also brings certain risks to the ATM automation system, which are mainly reflected in the following aspects:

- a) The problem of the radar transmission link causes a large area of false targets and STCA alarms occurring in the ATM automation system.
- b) The problem of north/sector report lost causes the radar failed and information abandoned directly by the ATM automation system.
- c) The geographic characteristics of the radar location leads to the instability of targets with specific azimuth attributes.
- d) The marginal coverage of the radar results in track speed jumping and vector line swinging.

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**2. PROBLEM ANALYSIS****2.1. Problems of the transmission links**

**Case 1:** due to the transmission delay of the Jinan Raytheon radar, a large area of false targets cause STCA alarms appearing in the ATM automation system of the Beijing ACC. After log analysis, the average transmission delay of Jinan Raytheon radar is 30 seconds, and the maximum delay reaches 50 seconds.

**Case 2:** the transmission equipment called FA36 of Chongqing Tiegangzui Thales radar, due to the semi-paralysis board of FA36 leading to a TCP/IP retransmission storm, give rise to a large area of false targets happening in Chengdu ATM automation system. According to the same track package at the same time during the statistical period, there are 17 repeated receptions at most.

**Case 3:** because the serial output port of Chongqing Yiwanshui SELEX radar is not properly connected, more than one hour of real track packets cached after the connection restored brings about a large area of false targets emerging in Chengdu ATM automation system.

**2.2. Radar North/Sector Report Issues**

**Case 1:**, due to the disorder of the north and sector reports of the Fenghuangshan SELEX radar, the Guangzhou ATM automation system directly discarded this radar data. It is understood that the radar antenna rotation produces the north report after passing the true north and generates sector report while crossing the sector boundary. However, it is necessary to wait for the targets processing of the sector to be completed (roughly 300 milliseconds) to output.

**Case 2:** Chongqing Yiwanshui SELEX radar, in the mono radar mode of the Chengdu ATM automation system, loses a large area of tracks, and the monitoring system shows the "TIME" filter icon. It is found that some sectors of the radar covering main airways result in a great number of targets. The delay of the sector report causes the calculation tolerance of the same target in the adjacent scanning period to exceed the system parameter value with respect to the azimuth of the radar, causing the plots to be filtered by the system.

**2.3. Problems Caused by the Geographic Environment Characteristics of the Radar Head**

The THALES radar in Chongqing Fangdoushan installs a large number of wind turbines during the construction period. Figure 1 shows the relative position of the radar and the wind power plant. The orange is the 222°-232° sector, and the purple is the location of the wind turbines, which is a straight-line distance about 16km from the radar station.

According to the specification issued by CAAC, there should be no large rotating reflectors, such as wind turbine generators within 16km of the ATC SSR. This radar is located in the critical position, so during operation, it is found that it is easy to cause target positioning errors within the range of 222°-232° of the radar, which leads to the target speed jumping in the Chengdu ATM automation system.

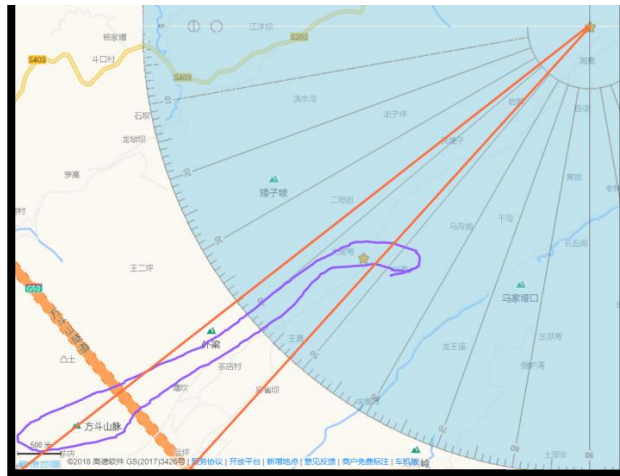


Figure1 Relative position of radar and wind power plant

## 2.4. Problem in Speed Jumping and Vector Swinging

In the ATM automation system, if the abnormal radar track deviates far away from the normal radar track, as shown in Figure 2, and the abnormal radar track has a higher weighting, the vector line of the track swings. When the plots of the radar appear to move forward or sway irregularly, the speed of the track jumps. The abnormal data, apart from problem in the radar itself, derives from factor of edge coverage.

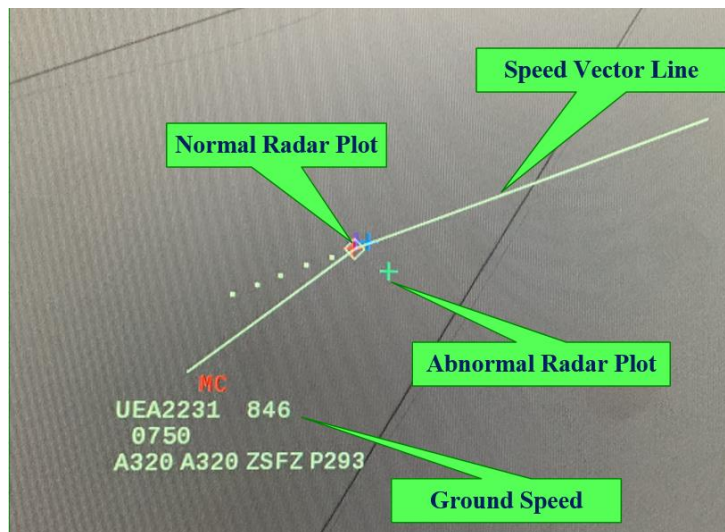


Figure 2 The abnormal radar track display

## 3. SOLUTION

### 3.1. Radar Equipped with GPS

If radar is connected to the GPS, under the condition of ensuring the accuracy of the time, the ATM automation system directly uses the UTC time stamp in the radar data. This greatly helps to reduce the risk of the loss of sector reports and the delay with respect to transmission link

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**3.2. Integrated Cutting Radar on the ATM Automation System**

In areas covered by multiple radars, elevating the criterion from maximizing range utilization of the radar to “accuracy use only” principle, the measures taken are as follows:

- a) To reduce radar coverage to mitigate unstable factors of radar edge track;
- b) To Set up blanking area, similarly to the impact of wind power station on radar; and
- c) Typical problem radar, using the minimum criteria for access to reducing the impact on the surrounding area.

**3.3. Fine-Tuning of Radar parameters on the ATM Automation System**

In order to achieve the reliable convergence of the system track, by comparing the multiple coverage and overlapping targets of the radar, the blind compensation radar in the outer area and the radar with large deviation in the area is able to be adjusted. The ways paid attention as follows:

- a) To adjust the radar azimuth deviation angle;
- b) To adjust the radar range deviation value; and
- c) To fine-tune the latitude and longitude of the radar station.

**3.4. Radar Provided with SIC/SAC Recognition**

Radars in the area adopt SIC/SAC for unified management and planning, and the ATM automation system is activated to identify the radar SIC/SAC to avoid large-area false target incidents caused by incorrect radars connected.

**4. ACTION BY THE MEETING**

4.1 The meeting is invited to:

- a) note the information contained in this paper; and
- b) discuss any relevant matter as appropriate

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