

## Some Searching Methods For Lost Planes

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**Abstract.** In the morning of the 8<sup>th</sup> march 2014, the Malaysia Air's MH370 scheduled flight which was flying to Beijing lost connection with land. There are 227 passengers and 12 flight crews. After losing connection, the authorities started to search for the fragments of MH370, but they didn't find any fragment. Motivated to find the lost plane more accurately, we established two models to imitate the whole process of searching the lost plane. The process includes the falling process and the searching process. We provide several searching methods including sector search, extended square search, track line search, parallel line search, horizontal line search, moving rectangle search.

**Keywords:** Lost plane, Searching methods, MH370

### 1. Introduction

At 8<sup>th</sup> march, 2014. From the China Civil Aviation Administration air traffic control board was informed that the Malaysia Airlines B777-200ER aircraft (fuselage number 9M-MRO), the implementation of MH370 (Kuala Lumpur to Beijing) flight mission, take-off time 8 00:42 (Beijing time), However, Aircraft lost contact and the radar signal with regulatory agencies in Ho Chi Minh control area at about 01:20. and after relevant regulatory authorities' confirmation, the machine has not established contact with China's Control Department of our country or to enter China's ATC information region.

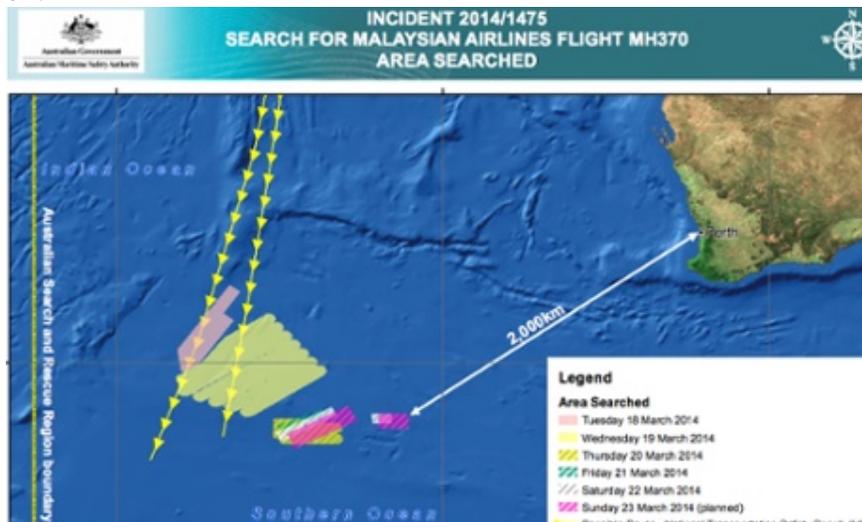


Fig 1. The part of searching the MH370[1]

As the figure 1 shown, the authorities were searching the fragments of MH370, so we establish models to offer a solution to the problems. We assume that we can't receive any signal from the down airplane. Then we establish two models to imitate the whole process include falling and searching.

### 2 The searching method

We have to search in the visual way, because the accidental aircraft lost signal when it fall. Now we provide following methods :

(1) Sector search

- (2) Extended square search
- (3) Track line search
- (4) Parallel line search
- (5) Horizontal line search
- (6) Moving rectangle search

### 2.1 Sector search

The sector search fit the accurate position and small range searching method. We use it to search the circle range. The specific steps are: put a symbol at the basic point as our searching center. As the figure 7 shown, the angle between two track lines depends on the estimated searching radius. In general, the sector searching radius is between 3 to 9 kilometers. The searching plane's swerving angel is 120 degrees every time. If we don't find the target after searching the whole circle. We should rotate the sector. Then searching in half of the central angle.

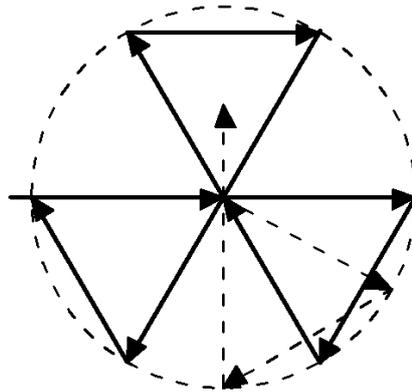


Fig 2.the model of sector search

### 2.2 Extended square search

Extended square search fit the near positions. We use it to search areas which the center are in the shape of spots and lines. The specific types are: put a symbol at the basic point as our searching center. As the figure shown, if the searching center is a spot, we will extend our searching range in the shape of concentric square. If the searching center is in the shape of a line, we should extend our searching range in the shape of concentric rectangle. The route is as the figure 8 shown.

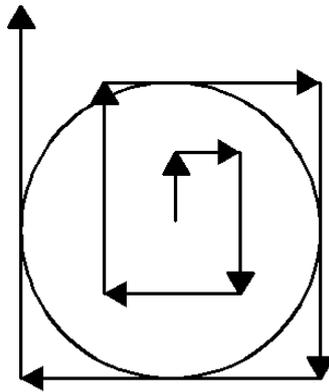


Fig 3.The model of extended square search[7]

### 2.3 Track line search

Track line search fit the uncertain position in the accident.We should focus the searching resource on the basic line.We should search in the direction of planned track line.This method needs us to keep parallel to the most possible track line.We can get the main searching method in figure 9.

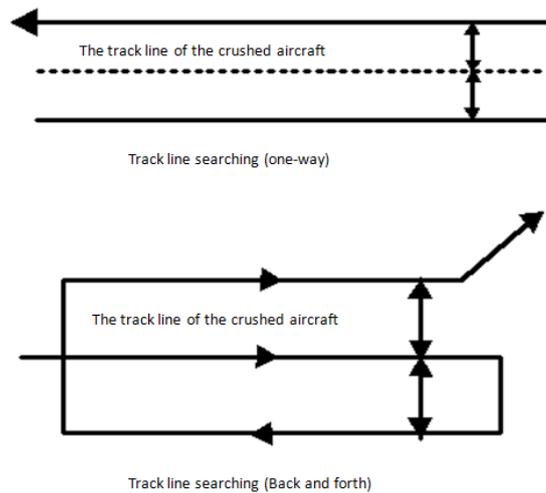


Fig 4.The model of Track line search

### 2.4 Parallel line search

We use parallel line search when the target's position is uncertain and the searching range is very large. The range of parallel line search is a rectangle.We can divide the searching area into some parts.Then arrange searching facilities at every small part we divided.At the process of parallel line search ,we should design the searching area at first.Then we decide the separation distance between the searching lines according to the accident situation.The searching facilities start searching from an angle of the searching area.The starting places are always in the middle position in the searching rectangle.Then they keep the separation distance.The specific route is shown in figure 10.

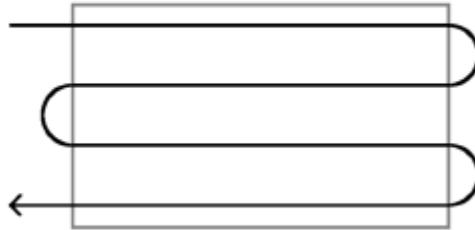


Fig 5.The model of Parallel line search

### 2.5 Horizontal line search

Except for that the searching line of horizontal line search paralleling to the short edge of the searching rectangle,the main method of horizontal line search is similar to that of parallel line search. The horizontal line search needs more swerves than parallel line search in the same range.This method is always used in the cooperation of aircraft and ships.We can get the method in figure 11.

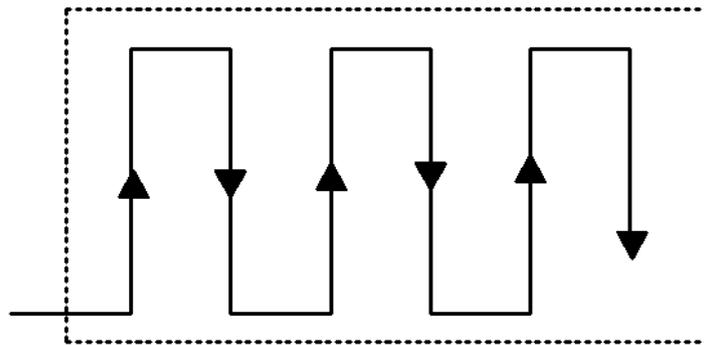


Fig 6.the model of horizontal line search

### 2.6 moving rectangle search

We always using moving rectangle searching method in the horrible searching situation.It can be seem as a transfer of the extended rectangle searching method.We can estimate the floating direction and speed and the error range.Then we can decide the searching area. Figure 12 shows the model clearly.

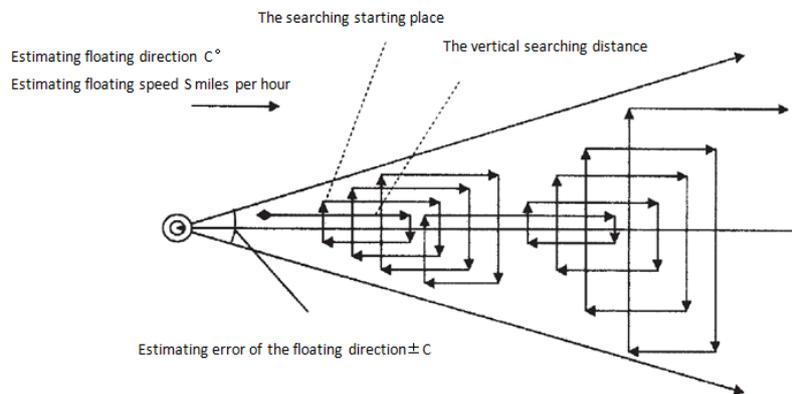


Fig 7.the model of moving rectangle search

### 3. Reference

[1] Information on:

[http://image.baidu.com/search/detail?ct=503316480&z=0&ipn=d&word=MH370&step\\_word=&pn=78&spn=0&di=82636823940&pi=&rn=1&tn=baiduimagedetail&is=&istype=0&ie=utf-8&oe=utf-8&in=&cl=2&lm=-1&st=undefined&cs=163588702,1369230065&os=1036648065,3955790958&simid=3393967621,446821186&adpicid=0&ln=1383&fr=&fmq=1453528473868\\_R&ic=undefined&s=undefined&se=&sme=&tab=0&width=&height=&face=undefined&ist=&jit=&cg=&bdtype=0&objurl=http://static.guim.co.uk/sys-images/Guardian/Pix/pictures/2014/3/23/1395547646350/74606212-f328-4bab-b65f-a6a202375a65-460x276.jpeg&fromurl=ippr\\_z2C\\$qAzdH3FAzdH3Fks52\\_z&e3Bftgw\\_z&e3Bv54\\_z&e3BvgAzdH3FfAzdH3Fks52\\_1uajwm98a8a8i5sc\\_z&e3Bip4s&gsm=1e9online](http://image.baidu.com/search/detail?ct=503316480&z=0&ipn=d&word=MH370&step_word=&pn=78&spn=0&di=82636823940&pi=&rn=1&tn=baiduimagedetail&is=&istype=0&ie=utf-8&oe=utf-8&in=&cl=2&lm=-1&st=undefined&cs=163588702,1369230065&os=1036648065,3955790958&simid=3393967621,446821186&adpicid=0&ln=1383&fr=&fmq=1453528473868_R&ic=undefined&s=undefined&se=&sme=&tab=0&width=&height=&face=undefined&ist=&jit=&cg=&bdtype=0&objurl=http://static.guim.co.uk/sys-images/Guardian/Pix/pictures/2014/3/23/1395547646350/74606212-f328-4bab-b65f-a6a202375a65-460x276.jpeg&fromurl=ippr_z2C$qAzdH3FAzdH3Fks52_z&e3Bftgw_z&e3Bv54_z&e3BvgAzdH3FfAzdH3Fks52_1uajwm98a8a8i5sc_z&e3Bip4s&gsm=1e9online)