Mathematic Models: Searching a lost plane

Introduction
Malaysia plane MH370 disappeared en route from Kuala Lumpur to Beijing on 8, March 2014. Whereas the seas and the oceans are relatively large and may pose a big challenge for search teams to locate a place. There is no doubt that air transport is so far one of the best modes of communication throughout the world. With increased levels of communication and the need to carry out overseas businesses and operations, it is inevitable for countries and individuals to carry out expansion and integrate air transport as part of the growth strategy. The only challenge that remains has to do with the issue of safety in as far as air transport is concerned.

Model Overview
We develop a model including two steps: confirming the area and then the optimum searching in the area.

First of all, to confirm the area that the plane probably falls, we assume it falls along with a parabola ignoring wind resistance and horizontal lift. The Poisson Probability Distribution is adapted to calculate the probability distribution of the accident and the probability of direction of the airplane. We use this theory to model the situation of general types of airplanes.

The second layer is to propose the famous Bayesian statistics and mathematical model for search of lost planes. The Bayesian Statistical model can indeed be used to help locate planes after they go missing. The Bayesian search theory and model can indeed be useful method from which the search for a plane can be enhanced.

Methodology
• Poisson Probability
• Drag equation: Drag depends on the properties of the fluid and on the size, shape, and speed of the object.
  We assume the point where airplane cast a shadow in the open ocean as origin in a Cartesian coordinate system.
  Probability about declaration of airplane course
  Analyze crashed airplane trajectory

Conferring layer
Probability about declaration of airplane course
When airplane lost powder during high-altitude flying, we could assume it was affected by different factors to crash.

Thus, we can build up an equation,
\[ E(\mathbf{n}) = A(x) + B(y) + C(z) \]
Where: 
- \( A(x) \) average affect by wind force factor
- \( B(y) \) average air current factor
- \( C(z) \) average airplane speed factor

We would get \( E \) as a real positive number from reality data that powder that affect airplane after lose power.

Since this lost airplane is flying from point A to point B, we could depend on time when airplane lose contact to get point C. Then according to drag equation, we could find that resistance in the point C as :
\[ f = 1/2 p v^2 C_d S \]

where:
- \( f \) is the drag force,
- \( p \) is the density of the fluid
- \( v \) is the speed of the object relative to the fluid
- \( S \) is the cross sectional area
- \( C_d \) is the drag coefficient – a dimensionless number

Since this airplane affected by four different forces in the air, we simplify that lift just affect vertical direction. We can use Newton’s law of motion to get:
\[ \frac{d^2 x}{dt^2} = -k \left( \frac{dx}{dt} \right)^2 \]
\[ \frac{d^2 y}{dt^2} = -mg + k \left( \frac{dx}{dt} \right)^2 - k_1 g \]

Strengths and Weaknesses
Strengths: Our model analyzes the problem as two layers: confirming the area and optimizing searching area. Our model has kinds of precise data and graphs to exhibit.
Weakness: In order to simplify the model, we neglect the wind resistance that would influence the direction of the rout of falling.