Contents

1 Problem Restatement

Searching for a lost plane:

Recall the lost Malaysian flight MH370. Build a generic mathematical model that could assist "searchers" in planning a useful search for a lost plane feared to have crashed in open water such as the Atlantic, Pacific, Indian, Southern, or Arctic Ocean while flying from Point A to Point B. Assume that there are no signals from the downed plane. Your model should recognize that there are many different types of planes for which we might be searching and that there are many different types of search planes, often using different electronics or sensors. Additionally, prepare a 1-2 page non-technical paper for the airlines to use in their press conferences concerning their plan for future searches.

2 Terminologies and Conventions

- **SAR**. Search-And-Rescue.
- **MTOW**. Maximum Take Off Weight.
- $\tilde{r}$. Distance between point of last contact and point of incident.

3 Assumptions and their Justifications

About the ***Missing Aircraft***

- **The initial search domain is an unobstructed rectangle of ocean with a length of 500km and width of 300km.** This rectangle would cover the whole uncertainty range based on the last known state of the lost aircraft for an interval of 15 minutes to 1 hour based on INMARSAT's "Log-on Interrogation" old and newly recommended standards in light of the MH370 accident[**citation**].
- **The missing aircraft is assumed to be still in this domain at $t = 0$.**

- **The crashed/force landed aircraft debris is assumed to be remain close and floating at all time.** The assumption is that not enough time have passed for important
- **The local trajectory of concern is straight**. In addition to the obvious smoothness arguments, it is always possible to apply a conformal transform on the
- **No banking maneuver was made from incident to crash.** This is reasonable for that even in the worse case of gliding due to single engine failure, the average time from initial to of roughly 11 minutes. no time for intentional changes on the large scale.
- **Hijacking or on-board navigation system only problems are not the cause of the incident**. Although hijacking incidents account for nearly 20% of all accidents in past 50 years **Citation!**, SAR plane (or vessel) detectors are largely useless in finding a cruising rouge plane. Also see problem restatement.
- **The missing aircraft can be accurately modeled as either G280, Boeing 737-900ER, or Airbus 380.** These three types of aircraft are well-known representatives of small private/business jets, medium range commercial flights, and large international flights. Cruise speed and other aircraft form factors (e.g. Lift to Drag ratio) are derived based on this assumption.
- **Aircraft is operating at MTOW**. Assuming they have cargo and passengers
- **Cruise altitude of all types of aircraft is assumed to be the same**. Describe/Justify.

About the ***Search Agents***

- **All agents are commanded and controlled by the central planner at each update interval**.

- **Agents arrive at the boundary of the search domain at** $t = 0$. Search agents are assumed to edge instantaneously. a/c is in initial domain.

- **Unlimited bandwidth between search agent communications**. This is necessary from a planning perspective as to ignore the less than pertinent issues with sensor fusion and coordination. Moreover, this factor is more than likely fixed by the hardware.

4 Literature Review

5 Criteria for Optimal Solution

6 Describe Your Method

6.1 Description

6.2 Mathematical Interpretation

6.3 Comparison to Most Interesting Literature Paper

7 Comparison to a Greedy Algorithm

8 Experimental Setup

9 Results

10 Sensitivity to Parameters

11 Strengths and Weaknesses

Strengths:

- **Short bullet point**. Description.
- **Short bullet point**. Description.
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- **Short bullet point**. Description.

Weaknesses:

- **Short bullet point**. Description.
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- **Short bullet point**. Description.

12 Conclusion

- **Recommendation 1**. Why the data says so.
- **Recommendation 2**. Why the data says so.
- **Recommendation 3**. Why the data says so.
- **Recommendation 4**. Why the data says so.

References