Background

- UAVs in the national airspace are rapidly increasing creating an increased rise of UAV collision
- [1] has successfully modeled the problem as an MDP
- Other institutions such as NASA and the FAA are also developing their own logic

Problem: UAV’s will be equipped with various logics creating a need to coordinate different logics to ensure that all UAV encounters avoid collision

Solution: a standard coordination table can be queried before any maneuvers are performed

References


Dataset

- A policy from [1] gives an ownership and intruder bank angle for every location in a spatial grid
- Using the policy generator in [1], 34 different policies were created by adjusting the reward function (safe and unsafe policies were created)

Experiments

- 6 different policies were selected to use for the coordination table investigation, a sample is shown
- Each policy was run on 100 encounters that are created to induce collisions, starting locations of the ownership and intruder shown
- For each encounter, the number of collisions and alerts for each policy was recorded

Methods

A “super policy” was created in the following way:
- A policy is created for each point in a grid so nearest neighbors was used to find what encounter start position best matches the grid node
- The “super policy” at this grid node becomes the policy that is the safest with the fewest alerts for the corresponding encounter – ties broken using metrics for all 100 encounters

The ownership and intruder “super policies” were combined to create a coordination table
- The coordination table dictates if the ownership and the intruder should maneuver in the same direction, maneuver in different directions, or continue straight

Results

- A coordination table was created which serves as a proof of concept
- Using the framework in [1] the coordination table can be generated for various UAV speeds, headings, and pilot responses

Conclusions and Future Work

- A coordination table can be created and queried during UAV encounters to ensure safety
- Additional policies and encounters should be used to create a more robust coordination table
- Simulations need to be run for aircraft with different policies interacting with the coordination table
- Multi-UAV encounters need to be considered