

Cooperative Orbiting

Objective: Keep target in camera view even with possible occlusions while satisfying UAV dynamics

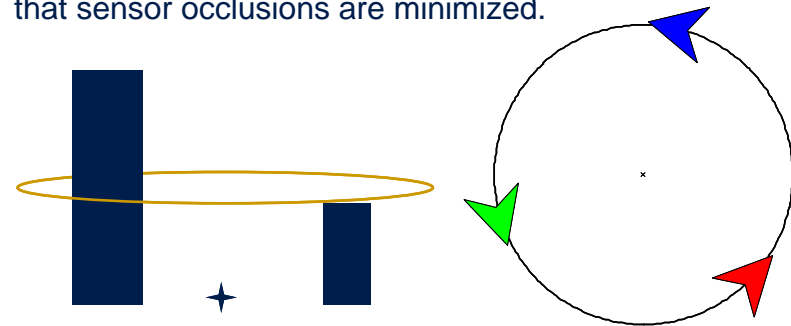
Principle Investigators: Randy Beard

Sample Publication: Derek B. Kingston, Randal W. Beard, "UAV Splay State Configuration for Moving Targets in Wind," in *Advances in Cooperative Control and Optimization*, edited by Michael J. Hirsch, Lecture Notes in Computer Science, Springer Verlag, (to appear).

Funding Source: NSF, AFOSR.

Problem Summary

A team of UAVs, each equipped with a gimbaled camera, are orbiting a moving ground target. The UAV autonomously distributed themselves around an orbit so that sensor occlusions are minimized.



Approach

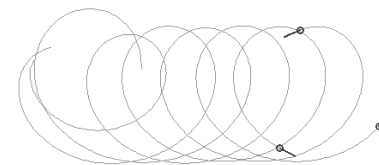
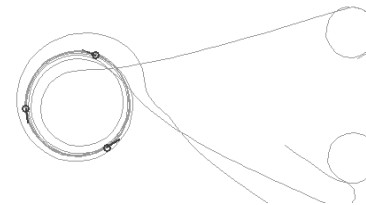
Heading command is proportional to (1) distance from orbit, and (2) relative spacing. Essential idea: UAVs increase or decrease radius to achieve spacing.

$$\psi^d = \psi^p + \tan^{-1}(kR - \gamma\delta\theta)$$

Salient Features:

- Decentralized – Only neighbor information required
- Robust to insertion/deletion
- Constant UAV velocity
- Guaranteed to space UAVs equally along the orbit
- Minimizes lateral motion of object in image.

Results



- Successful flight test with three UAVs in summer 2007.
- Can adapt to moving targets.
- Can adapt to heavy winds.