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Agent applications in traffic and transportation

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Air traffic management domain

- Currently the management based purely on human factor (air traffic controllers)
- Predicted increase in number of flights
- Current system is not sustainable in long term
- Need to solve the planning problem and collision avoidance problem

Air traffic simulation systems overview

- NASPAC 2.0
  - Event based simulation
- FACET (NASA Ames)
  - Queue based techniques
- ACES (NASA Ames)
  - Multi-agent approach, one thread per flight
  - 50.000 flights on 40 airports simulated in 90 minutes
- AgentFly

AgentFly overview

- Multi-agent distributed simulation
- Path planning
  - Accelerated A* Algorithm
    - Using the adaptive sampling step
    - Using similarity checks and hashing
- Collision avoidance multilayer architecture
  - Cooperative
    - RBCA
    - IPPCA
    - MLCA
  - Non-cooperative

AgentFly scenarios

- Human Asset
  - Free-flight concept, flight plan descriptions, special use airspaces, planning algorithm
- Rule-based Collision Avoidance
  - Inspired by visual flight rules
  - Horizontal manoeuvres only

AgentFly scenarios

- Iterative Peer to Peer Collision Avoidance
  - Collisions solved pair-wise
  - Solution for the first collision is found
  - Solution of the collision can't break solution of any earlier collision
- Multiparty Collision Avoidance
  - Division of airplanes to groups based on collision participations
  - Solution more "compact" than for IPPCA, but higher bandwidth requirements

AgentFly scenarios

- Landing
  - 20 airplanes
  - Can change speed only
- Mixed Initiative
  - Combination of cooperative and non-cooperative collision avoidance methods
  - Scenario above Los Angeles
    - 2 flows of airplanes landing at the airport
    - 2 UAVs on their surveillance mission