

Overseer:
Multiple Unmanned Aerial
Vehicle Management System

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Outline

- **Background**
- **Swarm Level Commands**
- **A Cueing System**
- **Selection Methods**
- **Viewpoint Navigation Methods**
- **Command Methods**
- **Conclusions**

Background - Needs

- **Need command system for**
 - Real-time interaction
 - Short-term combat tactics
 - Decision-making
 - 3D information
 - Addressing data overload and information camouflage

Background - Overseer

- **Uninhabited Air Vehicle Management Interface**
 - 3D graphical representation
 - 3D cursor in geographic volume
 - Section of groups, paths, and targets
 - Control of swarms of UAV entities
 - Attachable to existing simulation/command software
 - High Level Architecture (HLA) based
 - Test bed uses OpenSkies simulation software

Swarm Level Commands – Relevant Issues

- **Where and how does the UAV's autonomy interface with higher level commands**
- **Define a library of "swarm level" commands.**
- **Address how these commands translate into individual UAV commands.**

Ultimate goal: to understand the maximum number of UAVs a single operator, and a group of operators, can control.

Swarm Level Commands – Managing Multiple UAVs

- **Command-group definition – ability to divide the UAVs under operator control into subsets that can be given separate commands**
- **Other-group definition – ability to divide into subsets all other known vehicles/installations. Includes characterization of groups as a threat-type**
- **Path generation - command a UAV group to a location**
- **Relative posture command – command a UAV group to a position relative to another entity group**

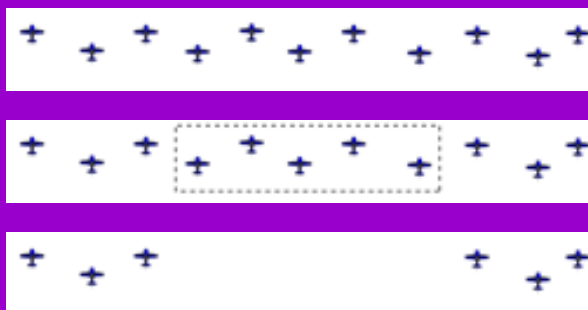
A Cueing System

- **Graphical differentiation – friendly vs hostile, controlled vs autonomous. Cues such as highlighting and group color**
- **Location cues – perceive 3D location of entities clearly, especially altitude. Includes 3D stereoscopy, artificial shadows, and drop-to-terrain lines**
- **Audio Cues – warning of proximity, velocity, and events such as missile launches, takeoffs, and landings**

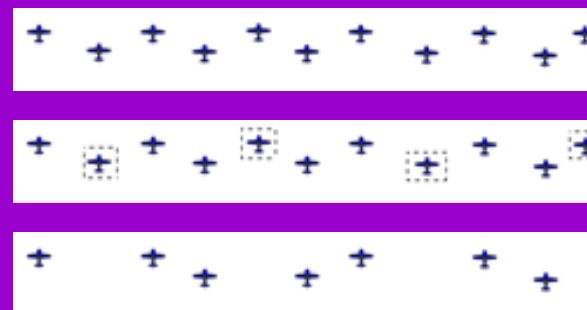
Selection Methods

- **Selection Tool Palette – different shapes for region selection, 2D and 3D**
- **Grouping – after selection, groups are identified using the Ctrl key and a number.**
- **Standard GUI Conventions – Ctrl+click, Shift+click, Double-click, Triple-click**
- **Fuzzy Selection – subset modifier of normal selection methods, by percentage or other categories (fuel, health, etc.)**

Selection Methods (cont.)



Traditional Selection Resulting in a
Tactically Poor Formation



“Fuzzy” Selection of a Third of the Units in
a Region, and the Resulting, Much More
Tactically Friendly, Formation

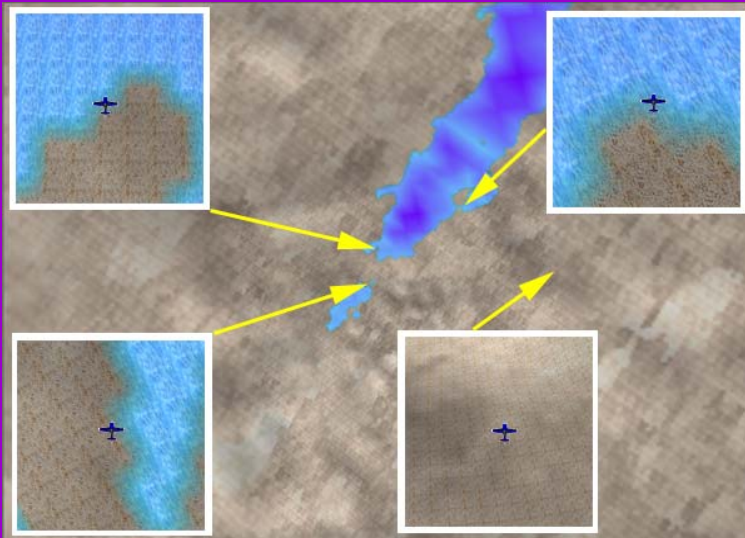
Viewpoint Navigation Methods

The Avatar's (or operator's) presence in the simulation, that is, the camera view, can be:

- **Free Fly** – allow the Avatar to move around the world at will, unattached to any object.
- **First Person** – puts the Avatar in the virtual seat of a UAV
- **Third Person** – allow the Avatar to “orbit” a single UAV
- **Bird's Eye** – similar to radar view, Avatar is high above, creating a 2-D like representation for big picture understanding.

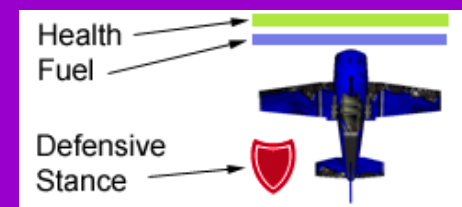
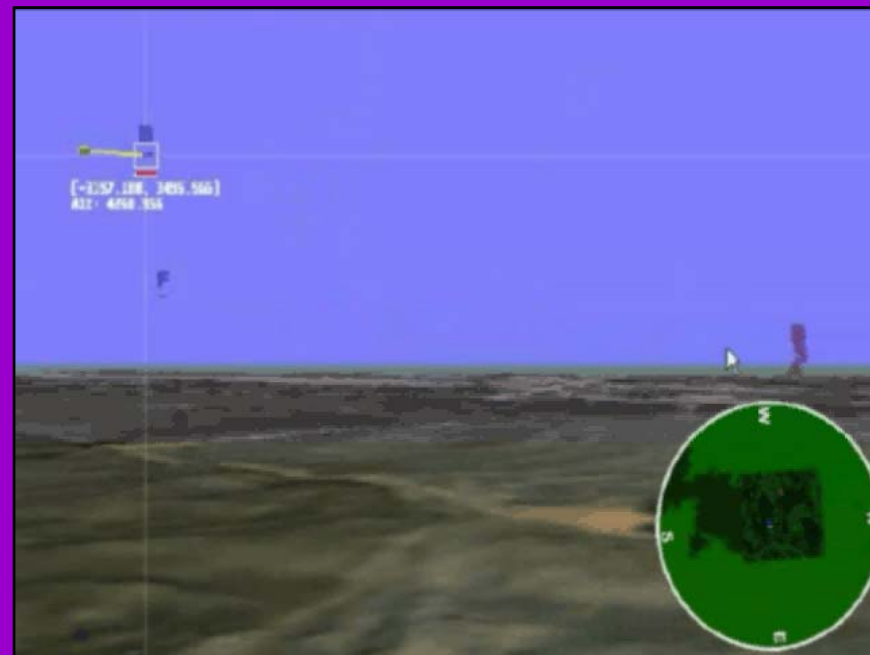
Viewpoint Navigation Methods (cont.)

- **Center of Mass – similar to Third Person, Avatar orbits the center of a group of UAVs**
- **Tactical Multi-View – allows view of all UAVs in simulation on a single screen, without need for exact distances between them.**



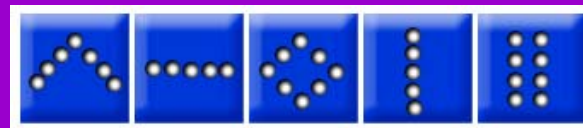
Information Display Methods

- Per Unit Graphics
- Message Console
- Event Queue
- Command Prediction
- Access to Detailed Information



Command Methods

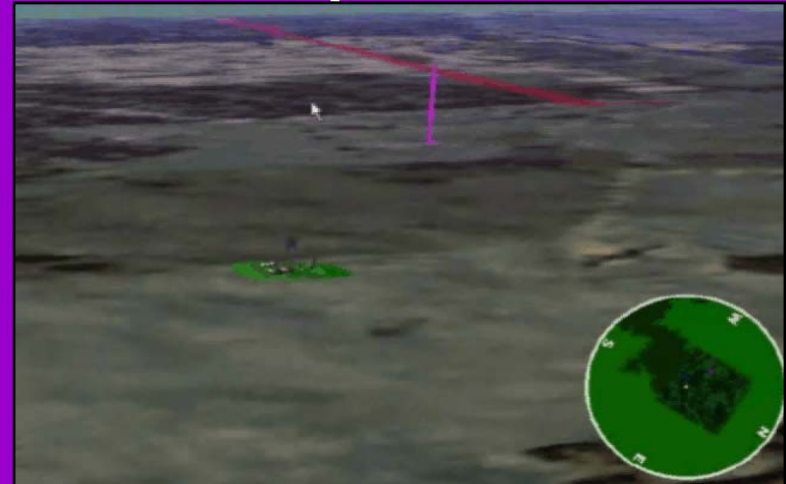
- **Travel** – “go to there.” 3D destination selection is not trivial
- **Waypoints** – specify multiple destination points, with additional waypoints allowed
- **Formations** – achieved through a “formation palette”



- **Distributions** – formation of group once the destination is reached, can be very complex
- **UAV-Specific Commands** – done by accessing specific types of UAVs

Command Methods (cont.)

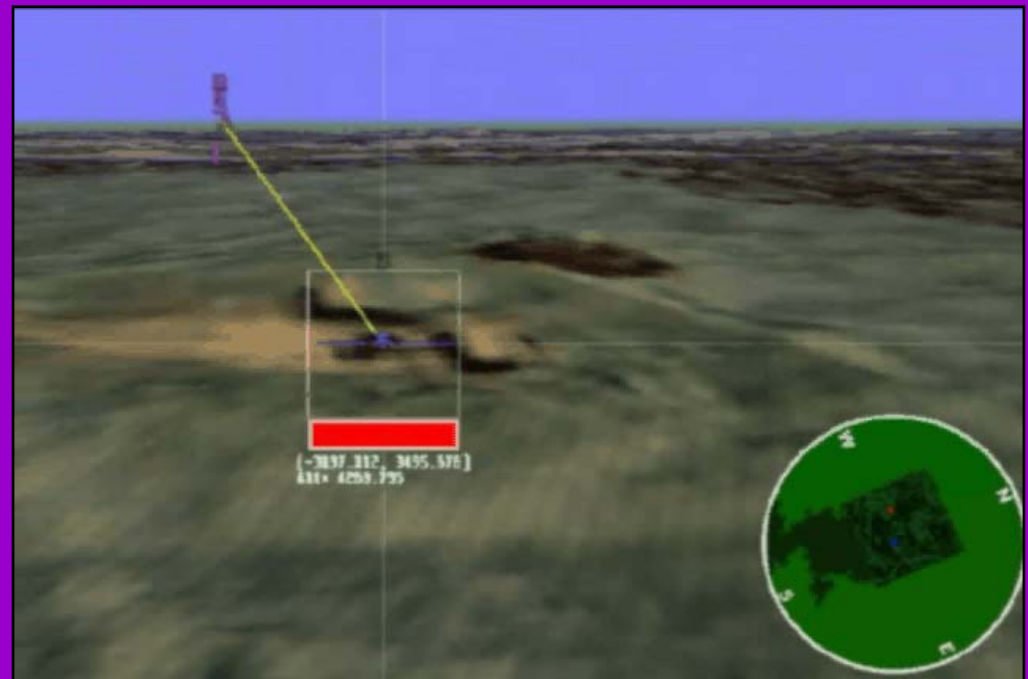
- **Stance/Attitude** – automated responses when events happen to UAVs while the operator is not directly observing them
 - Hostile
 - Guarding
 - Defensive
 - Observing
 - Spy
- **Command Queuing** – multiple commands executed in a specific order



Command Methods (cont.)

- **Wingman Mode – operator takes almost direct control of a UAV, and the other UAVs as wingmen. Sample commands are:**

- Follow Me
- Attack My Target
- Bomb My Target
- Defend me



Conclusions

- **Overseer: innovative interface for UAV**
- **Control swarms of UAVs in combat situations**
- **Detailed methods for**
 - Selection
 - Navigation
 - Display
 - Command

