Increasing Situational Awareness via UAV Video Feeds in GIS Applications

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Overview

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Abstract

With the emergence of UAVs and the video payloads available onboard, the integration of sensor data into a common framework referenced in a geodatabase is becoming more desirable. The USAF Academy’s Unmanned Aerial Vehicle (UAV) Research Group, a 25-member multi-disciplinary team, and the Academy’s Geo Integration Office are developing a prototype UAV Situational Awareness tool that will connect the commander in a command center to the video feed from an operational UAV. The prototype is being built as an ESRI ArcObjects extension for ArcGIS 9.0 that displays a moving UAV on the spatial data from the geodatabase and streams the video data to an embedded video viewer in the map. The result is a fusion of the UAV’s location and video feed into a common frame of reference. Using this tool in a command center during dynamic situations will increase the situational awareness of Air Force Commanders.
Purpose

- Connect Air Force commanders to UAV video feeds
  - Real-time feeds from operational UAVs
  - Increases situational awareness during dynamic situations
- Combine existing technologies
  - GIS systems, ArcGIS, ArcMap, etc.
  - UAV video feeds, EO/IR
  - Networking technologies
- Developing a prototype system
Background

- **US Air Force Academy**
  - Undergraduate institution with around 4000 cadets
  - 32 different majors including aeronautical and computer engineering

- **UAV Research Group**
  - 25 members from 11 different disciplines
  - $100K budget this year

- **USAF Academy Geo Integration Office**
  - Integrating GIS across the base
Background

- **Red Hen Systems**
  - Video capture and playback via GeoVideo™
  - Not real-time
  - Geo-referenced DVD video captured in flight
  - Replay video in ArcMap application

- **University of Nebraska gNet**
  - Interactive map of Lewis and Clarke explorations

- **Iwane Video GIS system**
  - View videos of selected locations, but not real-time
UAV Situational Awareness Tool
UAVSAT Client Server Architecture

- Airborne UAV captures video and telemetry
- Currently on separate wireless feeds
- Server computer
  - Connects to Ground Control Station (GCS)
  - Connects to video feed
- Client computers
  - Log into secure web site
Client/Server Architecture

UAV

Video antenna and receiver

Synchronization Board

GCS, controls the UAV with the Piccolo.

Server multi-streams the synchronized feed.

Multiple Computers

Computers running the GIS/ArcMap software that logs on to the Server via MMS
UAVs at the Academy

- Silver Fox
- Desert Hawk
- BATCAM
- Predator Engine testing
- Alpha 60
Results

- **Current prototype based on ArcMap**
  - Includes detachable video streaming window
  - Based on Microsoft’s Windows Media Player
  - Able to connect to UAVSAT via IP and stream video
  - Can display UAV on geo-referenced map

- **Next release**
  - Update UAV’s position in real-time and move icon
  - May use Tracking Analyst
  - Tracking Server sounds promising
Challenges

- Synchronizing video and telemetry
  - 10 second delay
  - Need to match location with video
- Investigating onboard solution
- May synchronize on the ground
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References


