COLORADO

Center of Excellence for Advanced Technology Aerial Firefighting

Department of Public Safety

CO-FPS Verification Plans for 2017 Fire Season

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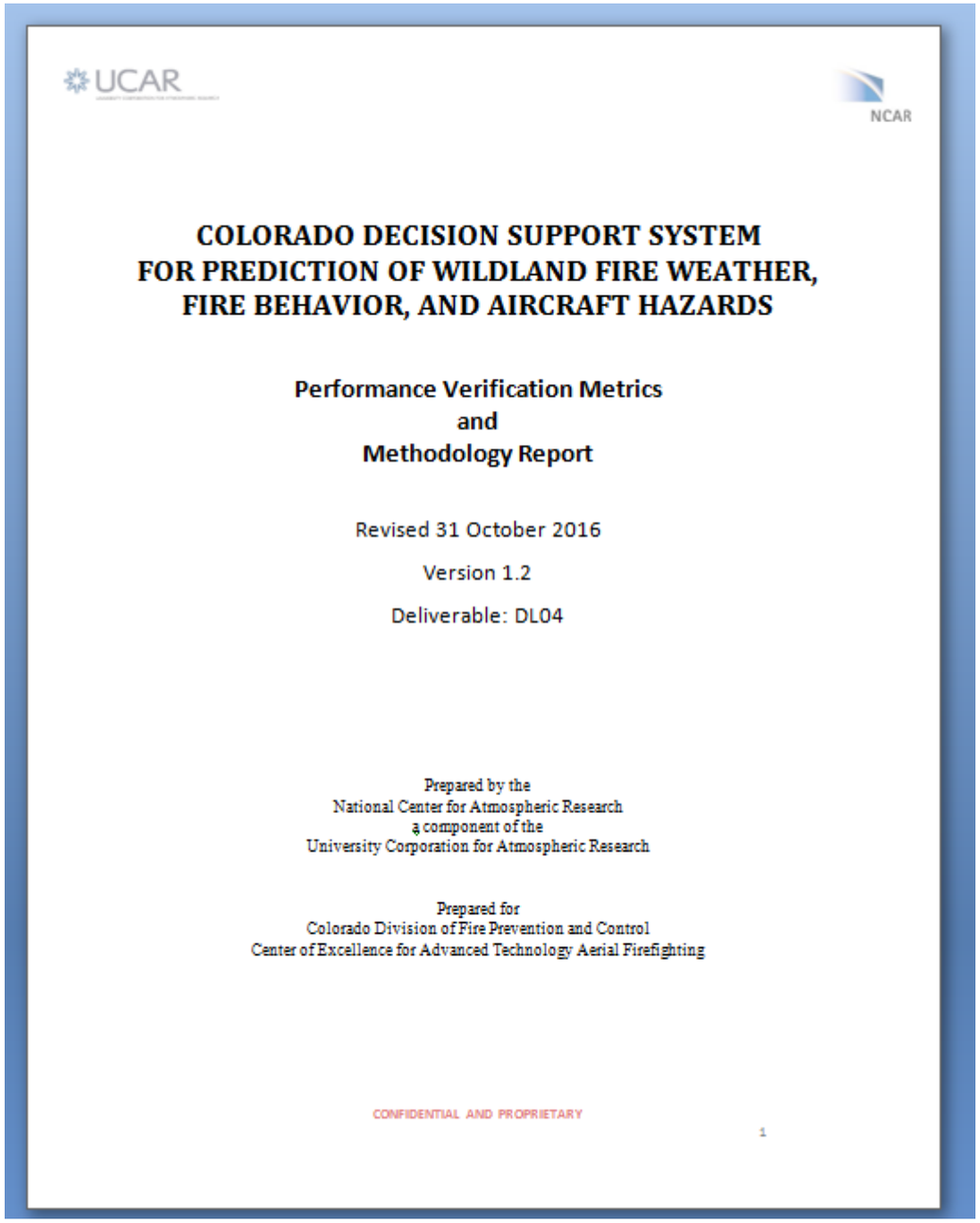
CO-FPS Verification Plan

- NCAR has developed a plan detailing the types of data that they need, and the analysis techniques they will use to conduct verification research

- Ideally, NCAR would like data on the actual values associated with all products from the CO-FPS model, including meteorological and fire behavior values

- The CoE has cautioned NCAR that large datasets of fire behavior / fire effects observations are difficult to find, and such observations are rarely systematically taken on wildland fires


UCAR

NCAR

COLORADO DECISION SUPPORT SYSTEM FOR PREDICTION OF WILDLAND FIRE WEATHER, FIRE BEHAVIOR, AND AIRCRAFT HAZARDS

Performance Verification Metrics and Methodology Report

Revised 31 October 2016

Version 1.2

Deliverable: DL04

Prepared by the
National Center for Atmospheric Research
a component of the
University Corporation for Atmospheric Research

Prepared for
Colorado Division of Fire Prevention and Control
Center of Excellence for Advanced Technology Aerial Firefighting

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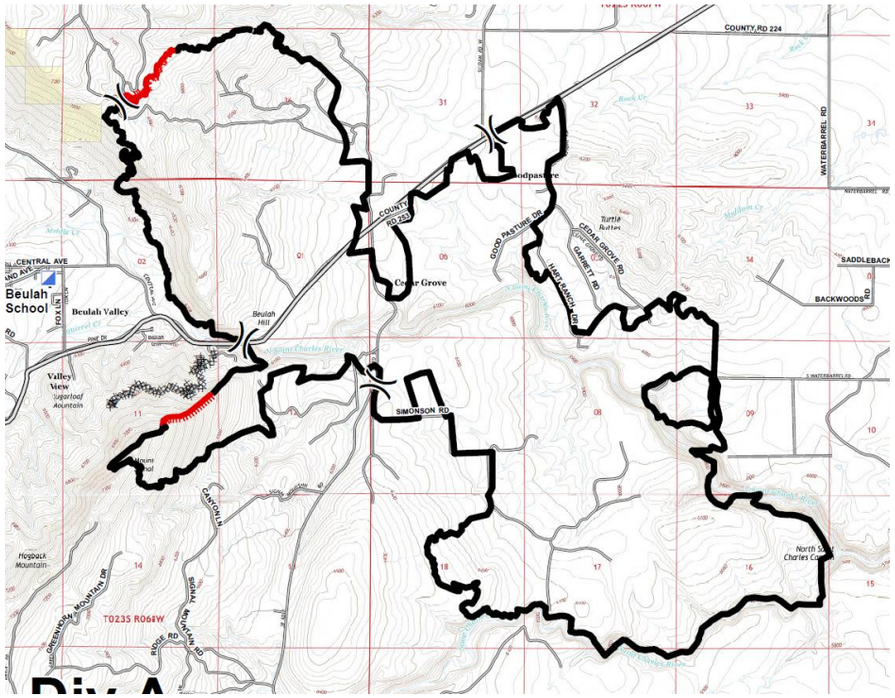
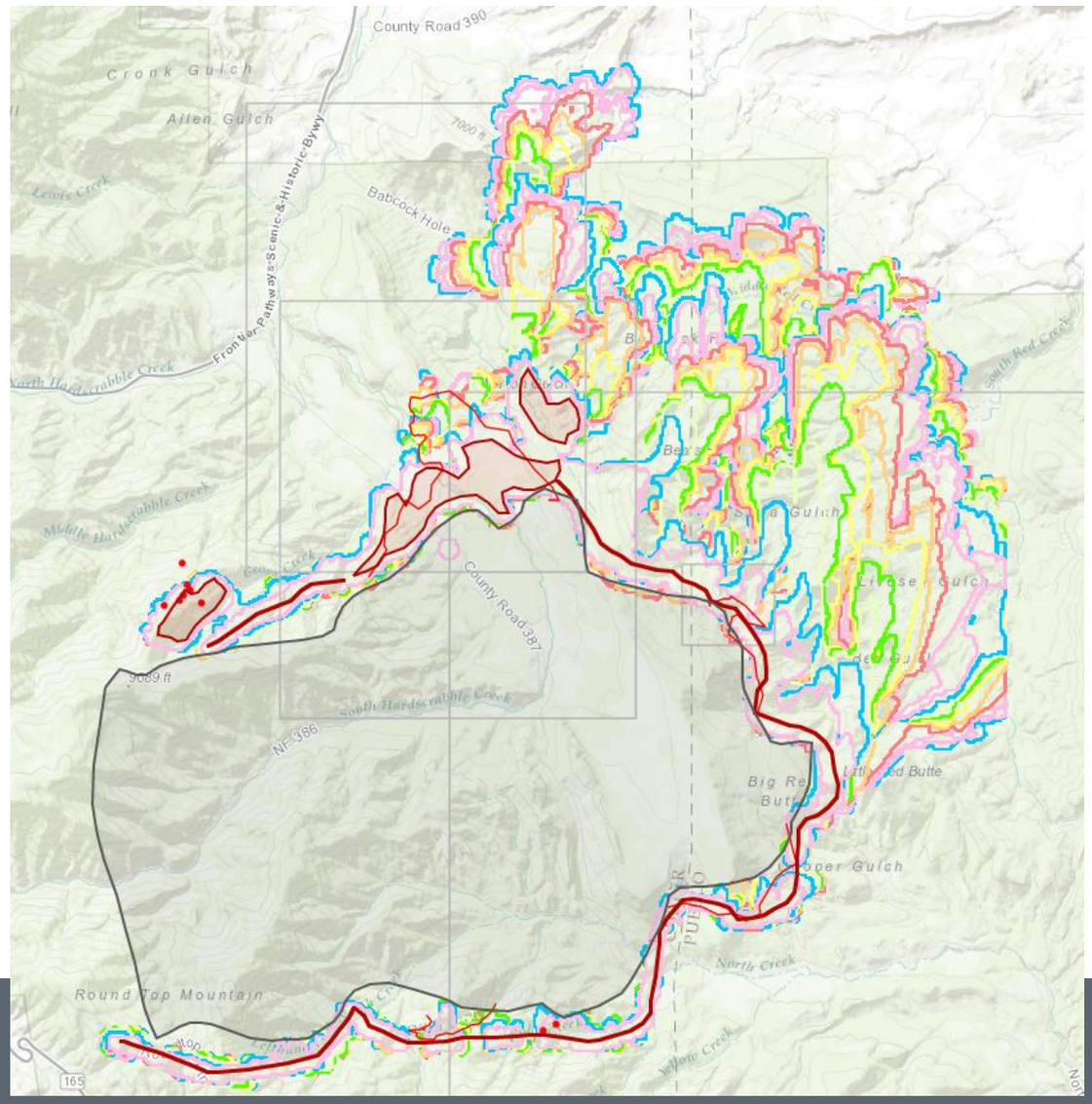
Verification Priorities

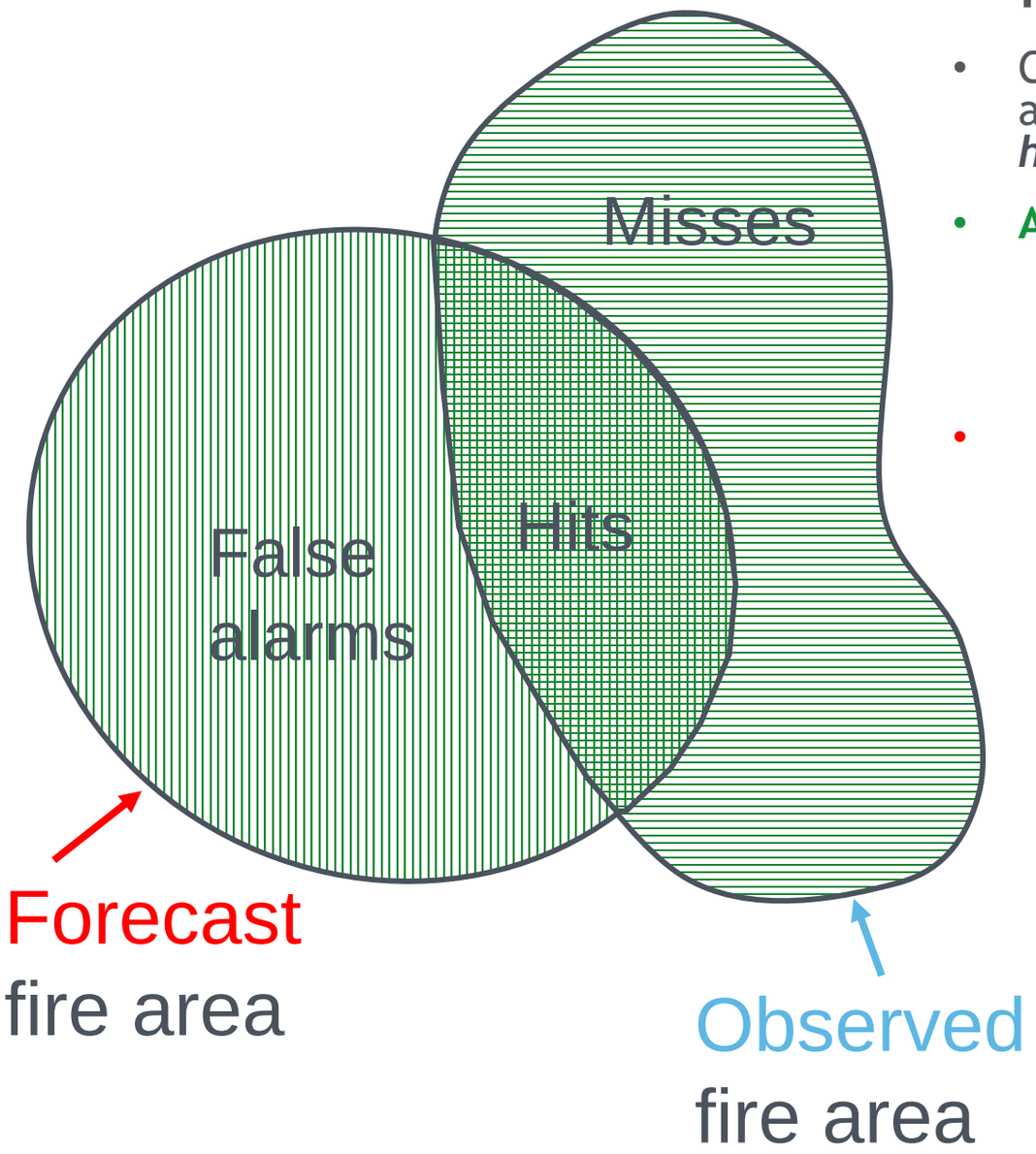
- The CoE and NCAR are in agreement that verification of predictions on a fire's extent/spread are a top priority

- This product of CO-FPS is appealing for verification study because it is of high importance to fire managers, and can be quantified for analysis using remote sensing and on-the-ground mapping of a fire's acreage





Methods for evaluation and verification of fire extent

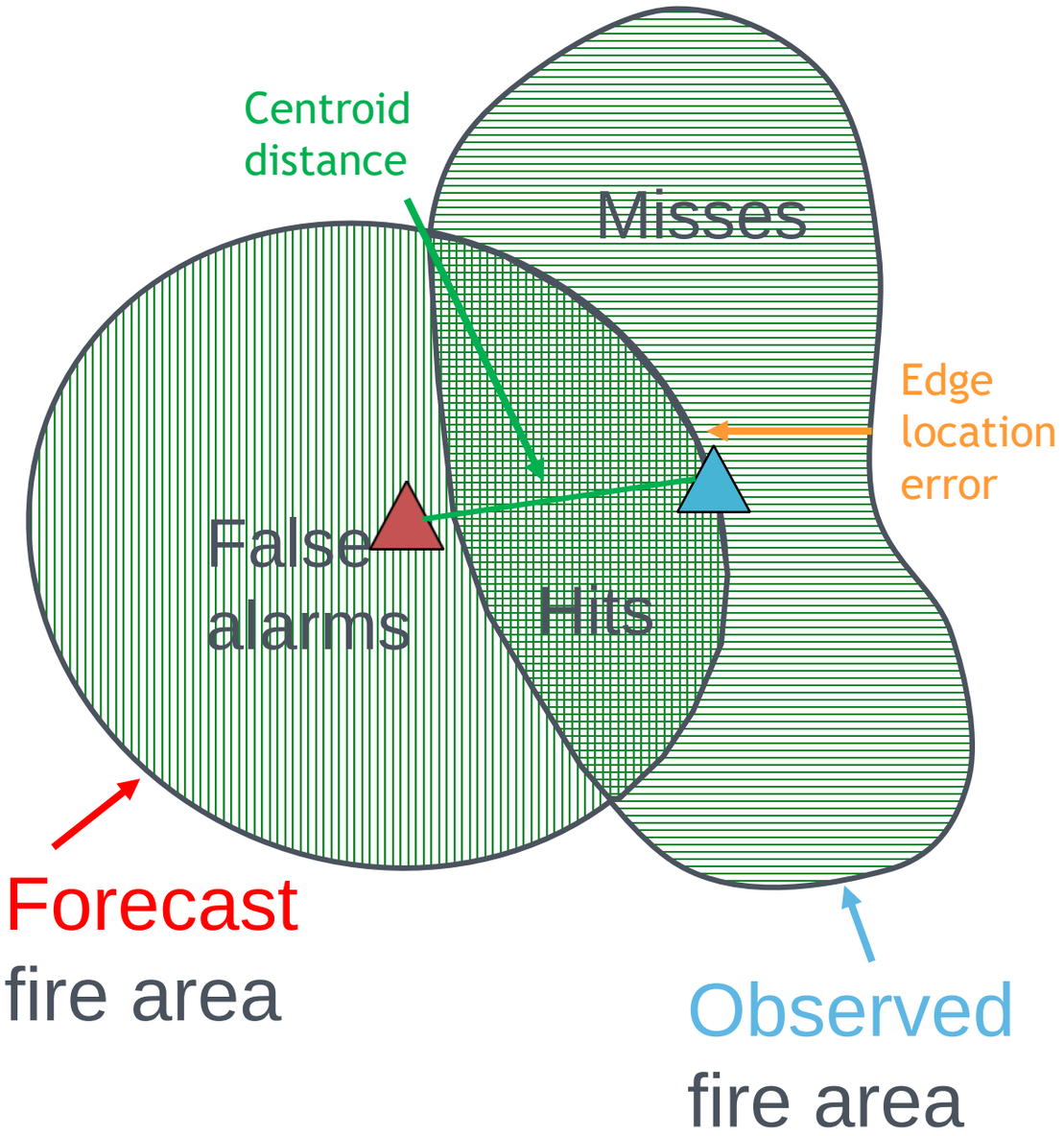


Traditional approach: Examine overlap between forecast and observed areas

- Compute various statistics that measure how well the forecasts and observations match on a ***gridpoint-by-gridpoint basis*** ***(i.e., hits, misses, false alarms, correct negatives)***
- **Advantages**:
  - Metrics are simple to compute
  - Provide simple summaries of performance
- **Disadvantages**
  - **Non-diagnostic:** Limited info about what went wrong or right
  - **"Double-Penalty"** issue: Forecast penalized for both false alarms and misses

		Observed	
		yes	no
Predicted	yes	*hits*	*false alarms*
	no	*misses*	*correct negatives*

Methods for evaluation and verification of fire extent



Spatial approaches: Evaluate and compare attributes of forecast and observed areas

- Measure features such as size, location, distance, shape, edge distance etc.)
- **Advantages**:
  - **Measurements are diagnostic**: What was good or bad about the forecast? (e.g., edge was not too far off, size was too large, centroid was offset to west)
  - **User-relevant**: Can define attributes that are meaningful for fire applications and decision making
  - Many options available: Many methods already exist
    - Object-based approaches
    - Distance metrics
- **Disadvantages**
  - Can be somewhat complicated to apply, but operational software exists (Model Evaluation Tools) and the fire application is easier than others that have been implemented (e.g., for precipitation)

Current Data Sources for Fire Mapping

- On the ground GPS data collection
- Remote sensing:
  - USFS NIRops program (1x per operational period, at night)
  - MODIS satellite (2x per day, 1 km resolution)
  - VIIRS satellite (2x per day, 375 m resolution)
  - DFPC Multi-Mission Aircraft (on demand)
  - AFUE aircraft with WAMI sensor (small subset of incidents only)

Plan for 2017 Fire Season

- NCAR will employ an intern with geospatial expertise to gather and prepare fire mapping data for comparison to CO-FPS simulations

- The intern will compile fire perimeters from federal sources and the DFPC MMA

- Our goal is to provide the statisticians with one fire perimeter every hour during limited time periods when case studies can be conducted with CO-FPS

MMA Data Processing

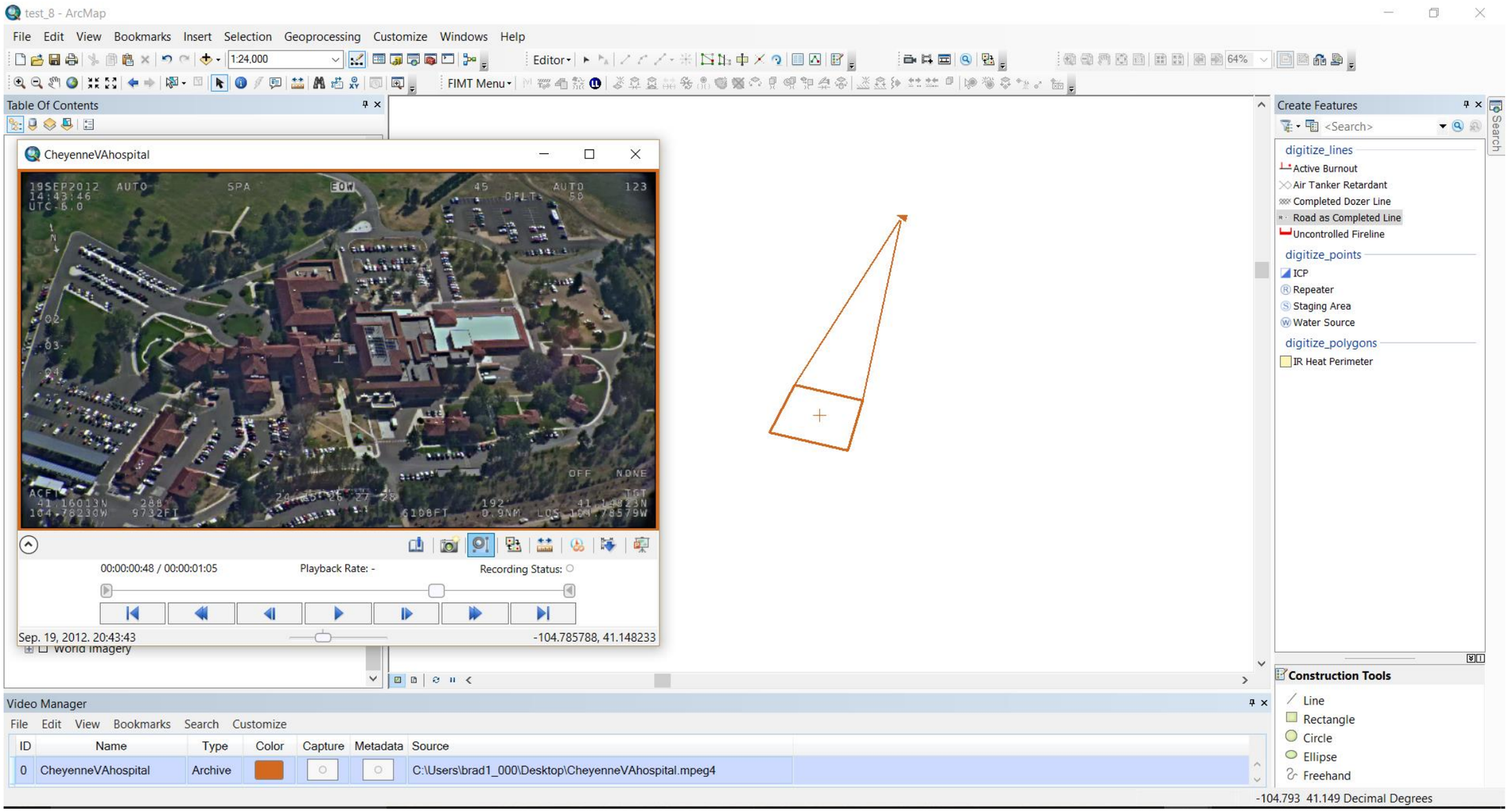
- The MMA currently collects one or two perimeters on a fire per mission, and may fly the same fire two or three times a day

- We will supplement the existing perimeters by conducting analysis on the video feed captured by the MMA

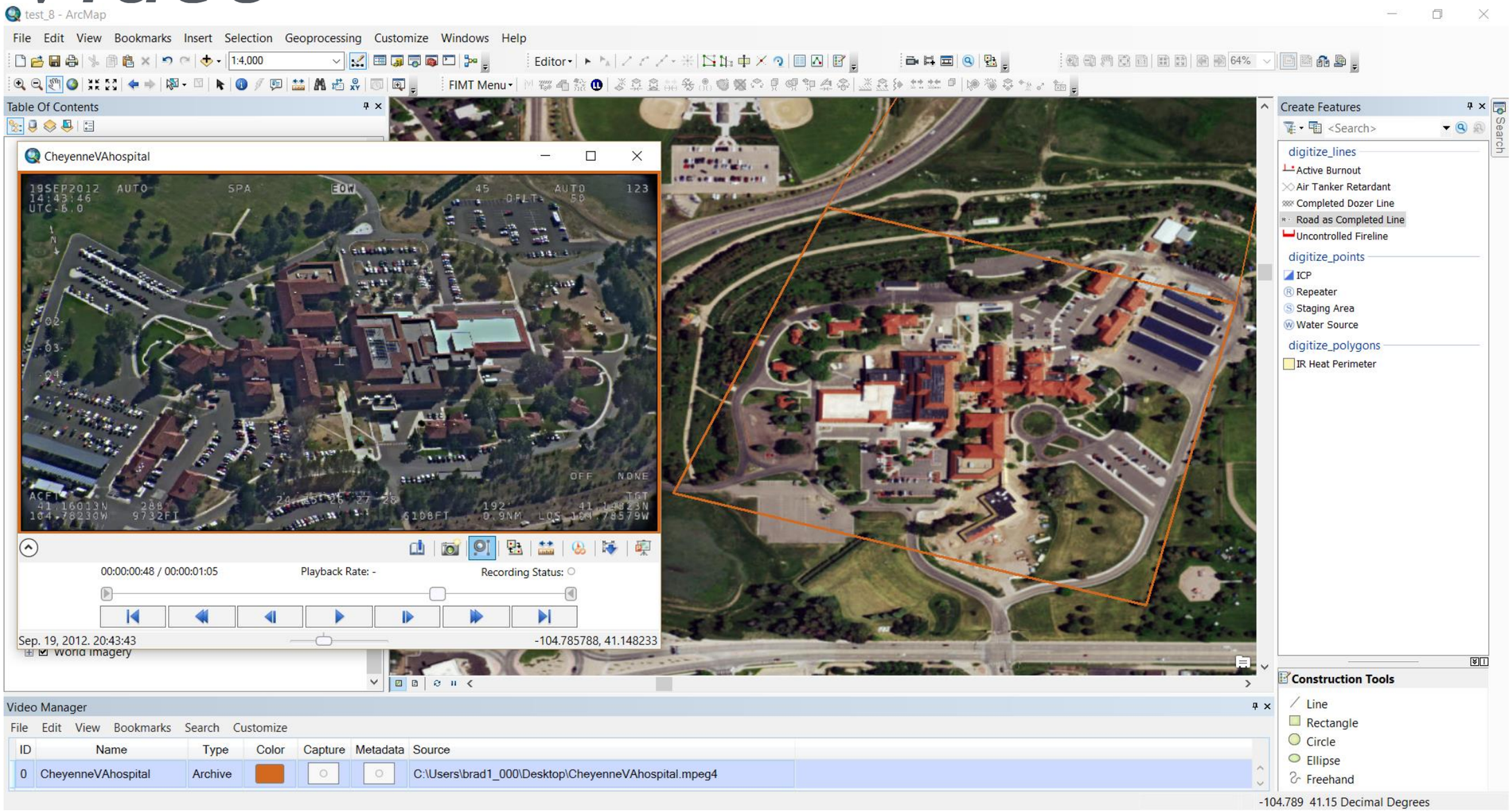
- Specifically the intern will use the Full Motion Video add-on to ArcGIS, which exploits the spatial metadata of the MMA video and allows the intern to draw on the video and instantly have that drawing mapped out

- As the aircraft orbits a fire and collects video data, there will be additional opportunities to map the perimeter of the fire using ArcGIS Full Motion Video

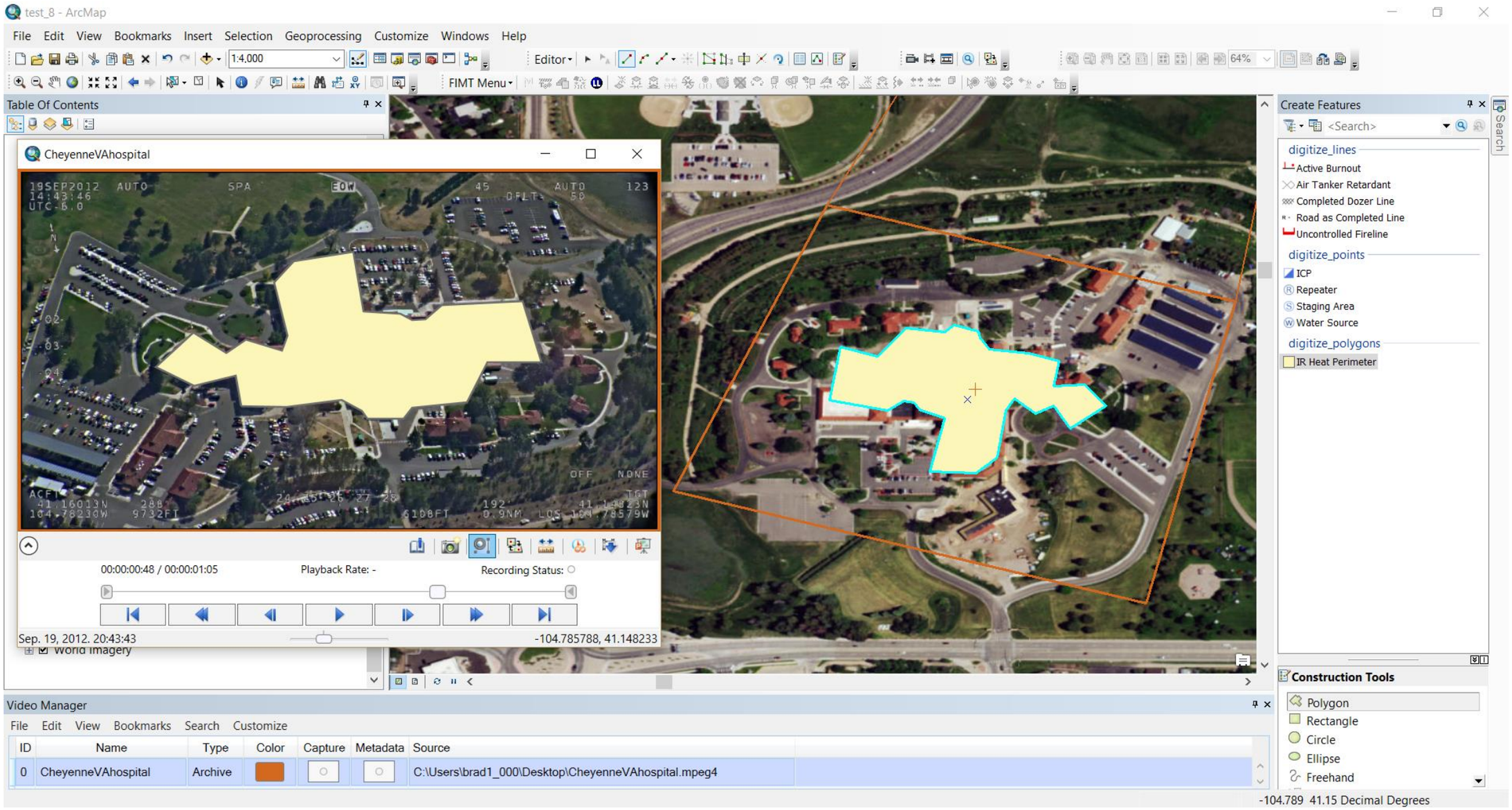
ArcGIS Full Motion Video



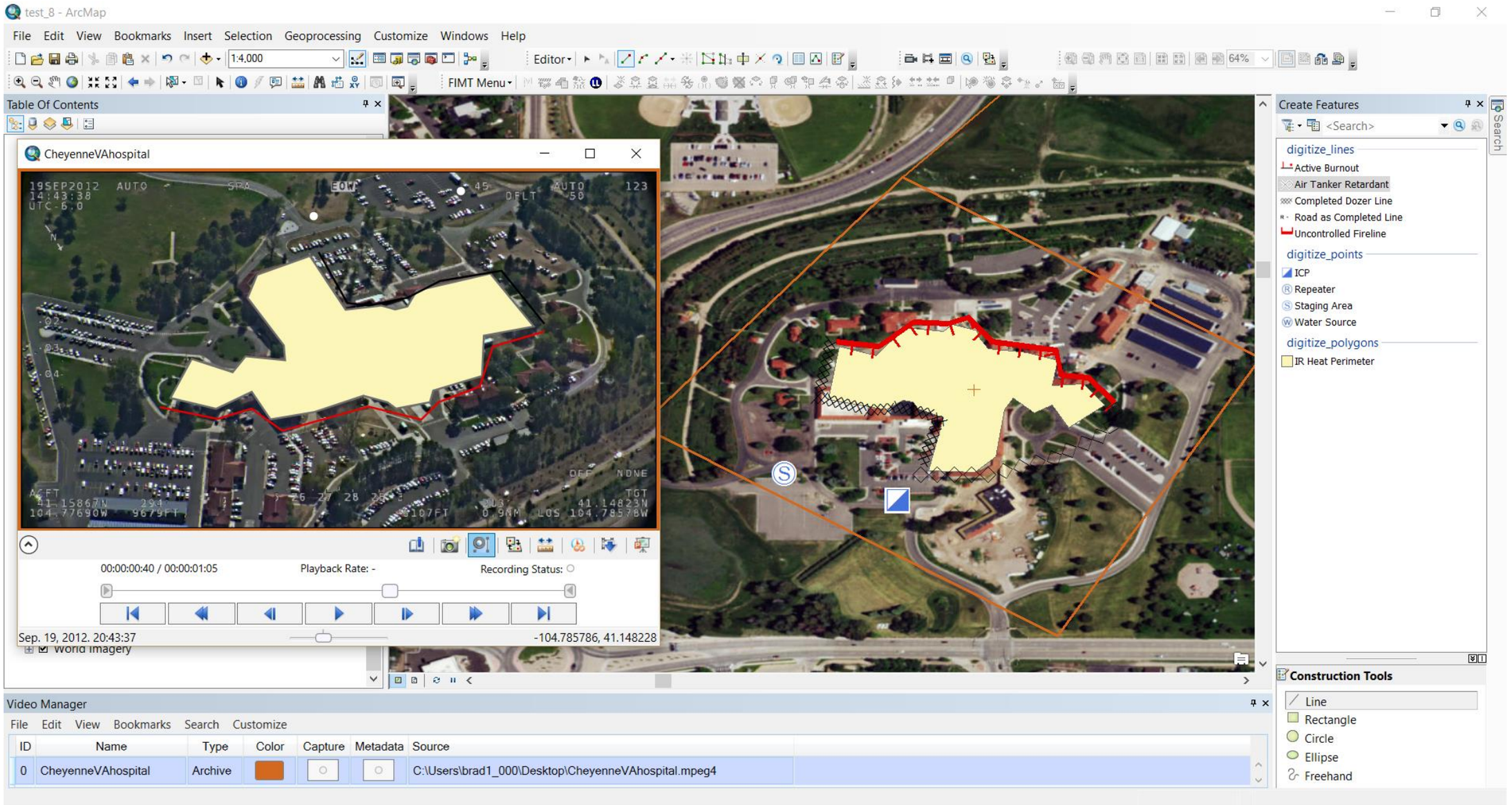
Continuity Between Map and Video



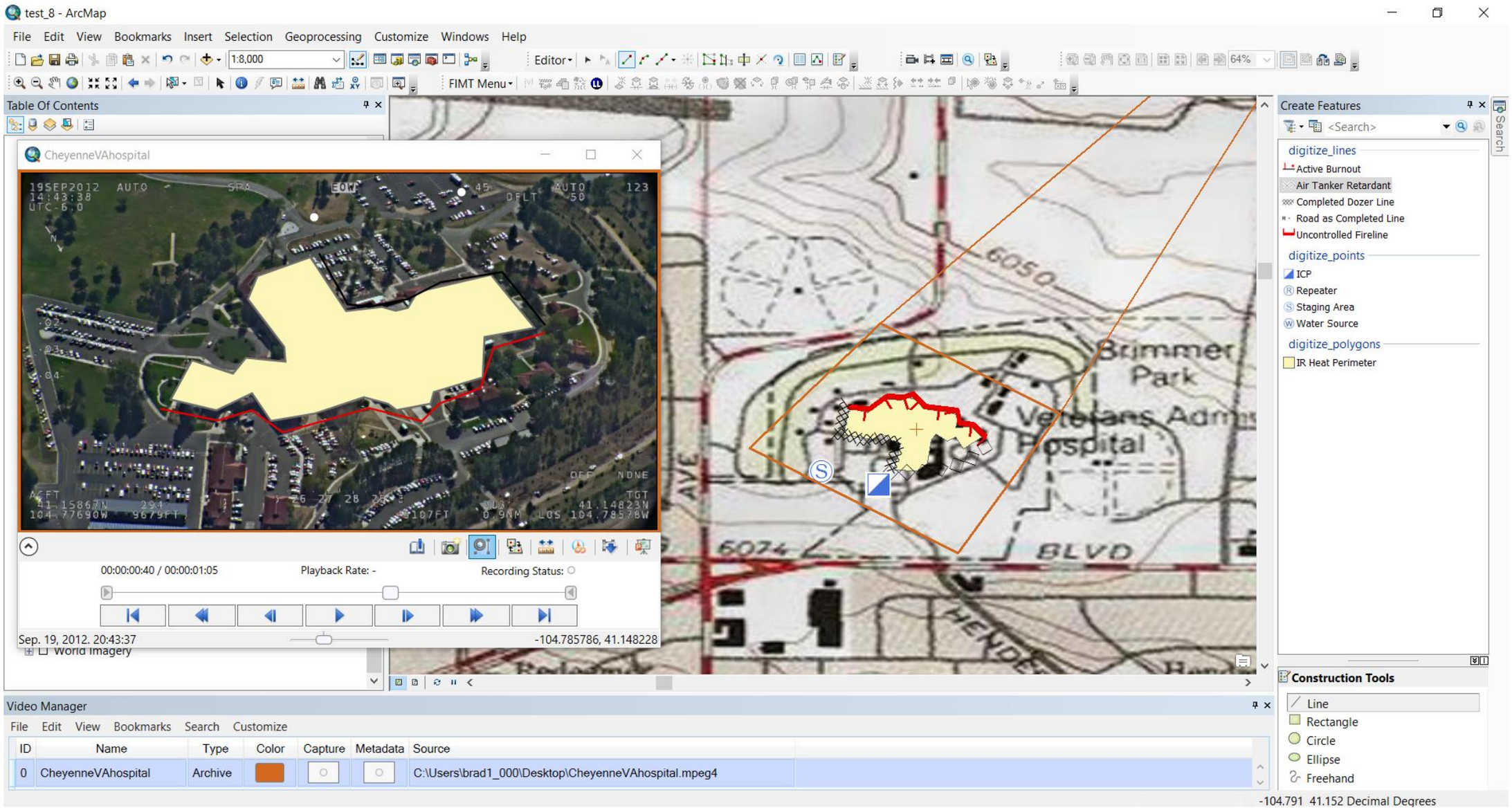
Digitizing Polygons



Adding Lines and Points



Mapped Data Over Topo Map



Wrap-Up

- Improving the accuracy of fire boundary predictions is a high priority for future CO-FPS development
- NCAR will gather and process fire mapping data throughout the 2017 fire season and will compare this data to CO-FPS predictions
- By processing video data from the MMA we will extract additional fire perimeters