An aerial photograph showing the aftermath of a tornado. The ground is covered in a thick layer of brown soil and debris. Several buildings are visible, many of which are severely damaged or destroyed. The roofs are missing, and the structures are exposed. The overall scene is one of significant destruction.

**Integrating a Geographic  
Information System into Storm  
Assessment: The Southeast  
Alabama Tornado Outbreak of  
March 1, 2007**

**Parks Camp  
NOAA/NWS, Tallahassee, FL**

# Overview

- March 1, 2007
- High Risk
- Long Track HP-Supercell
- 9 Fatalities (Eight at Enterprise H.S.)
- Significant Damage to mostly frame homes.
- EF-4 Rating
- Significant media attention

# Assessment

- Multiple assessment teams
- Quick Response Team
- Local Management
- Two aerial surveys (1 fixed wing, 1 helicopter)
- Ground photos mainly limited to area around High School

# Assessment

- Mass of photographic data difficult to visualize spatially
- Analyze Damage Patterns
- Relationship of damage to radar data
- Geographic Information System (GIS) ideal way to merge the available data

# Multiple Data Sets/Sources

# Multiple Data Sets/Sources

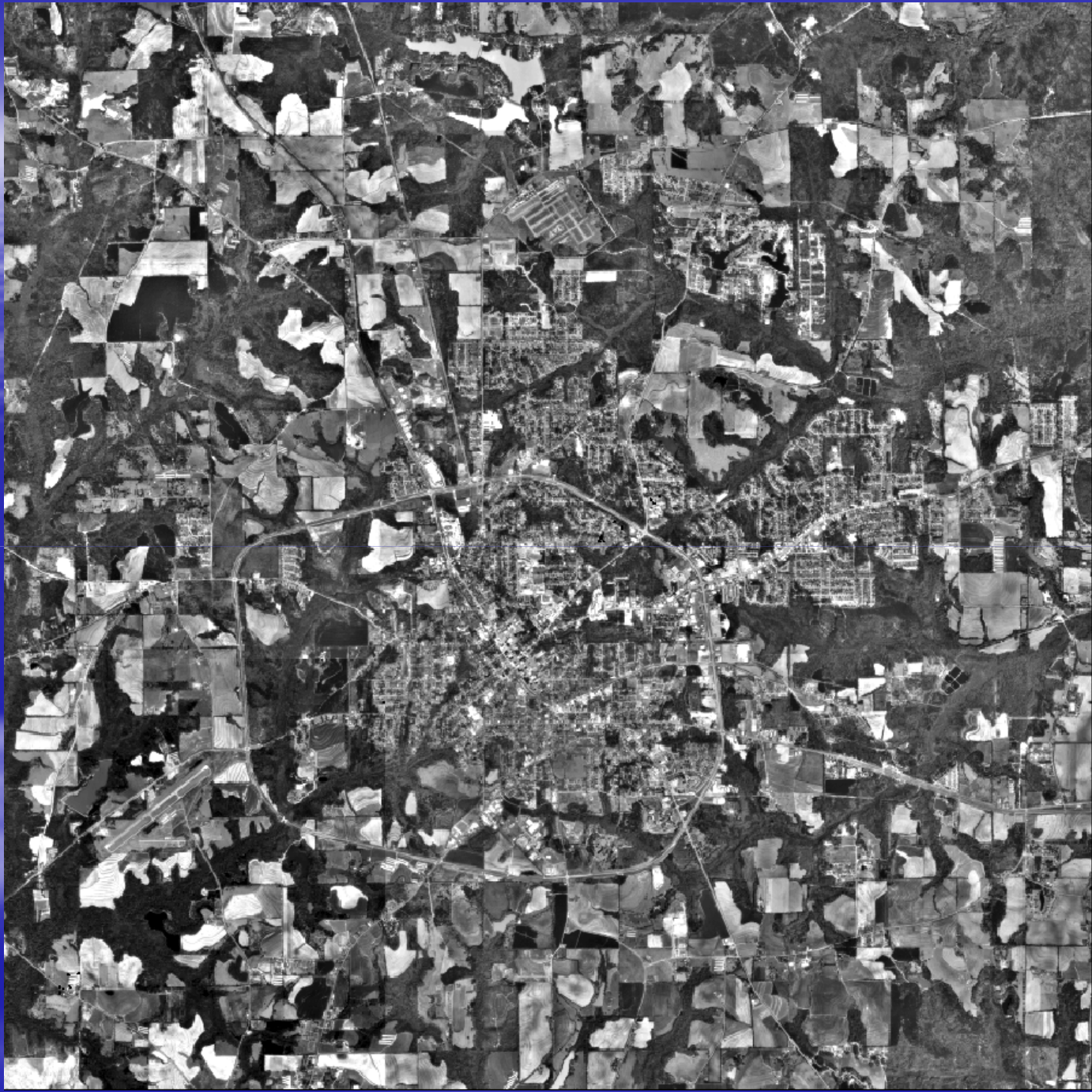
- **Photos – both aerial and on ground – with associated times**



# Multiple Data Sets/Sources

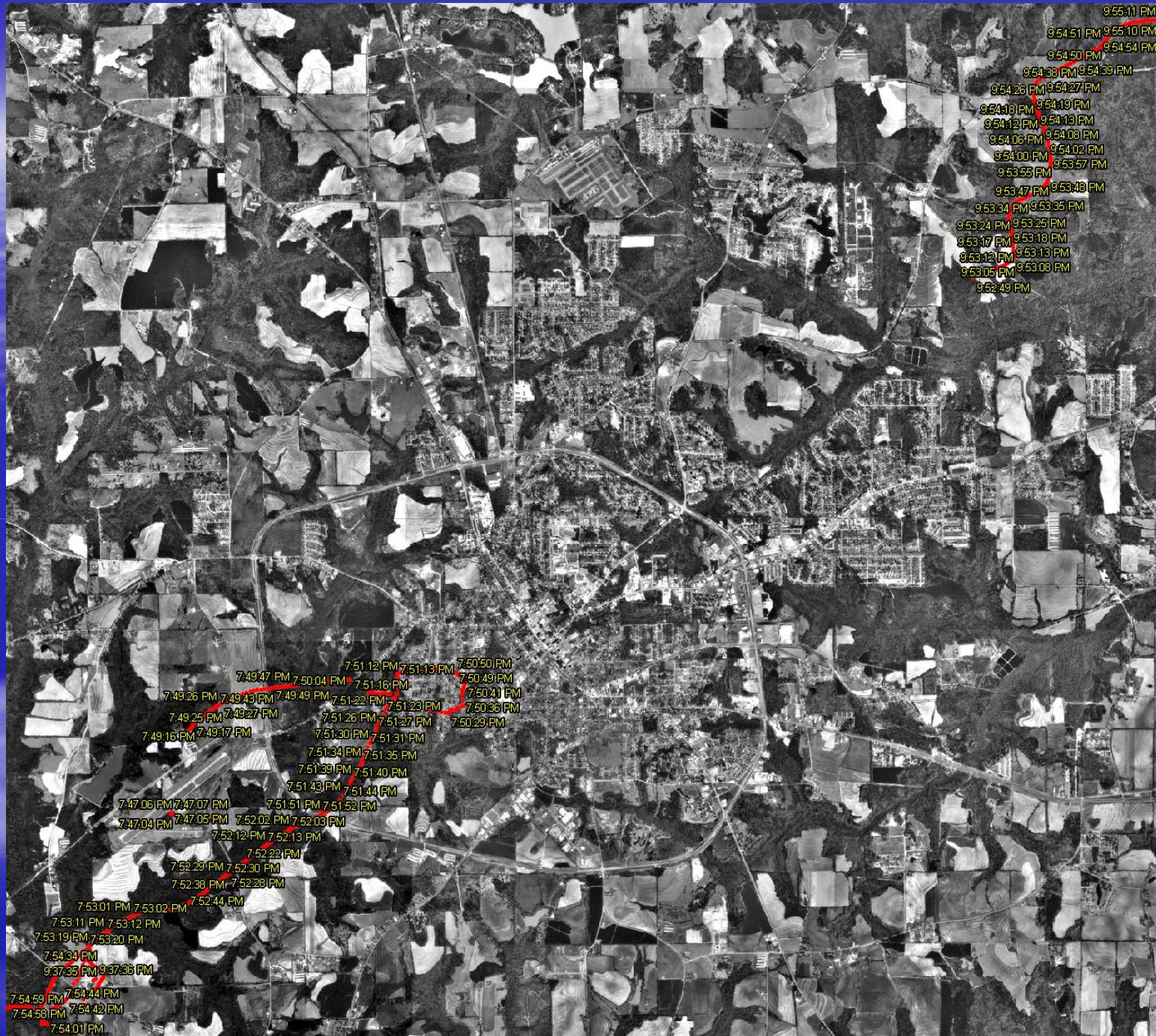
- Photos – both aerial and on ground – with associated times
- **Ortho-rectified imagery from USGS**





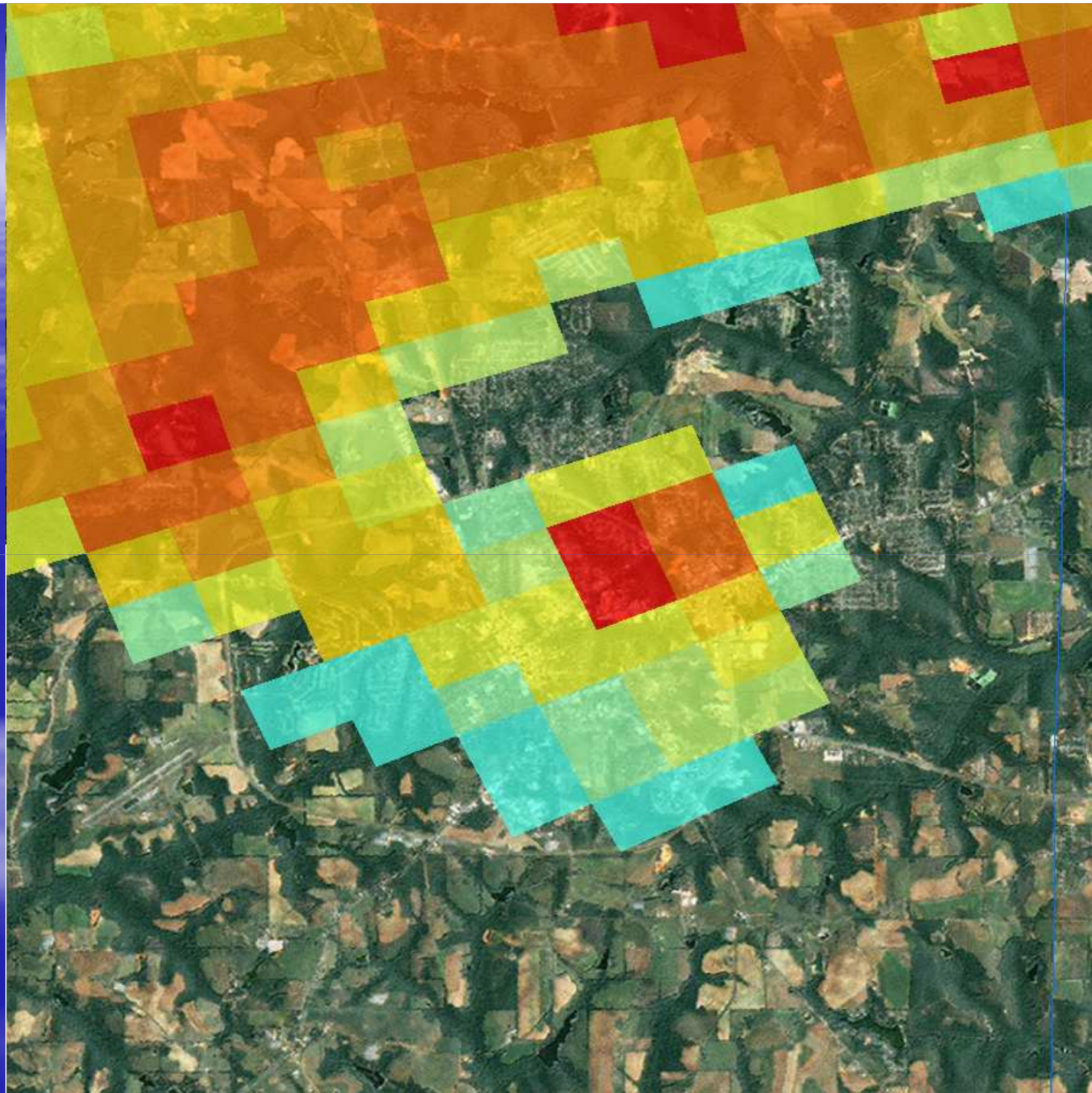
# Multiple Data Sets/Sources

- Photos – both aerial and on ground – with associated times
- Ortho-rectified Imagery from USGS
- **GPS flight track coordinates and timestamps**



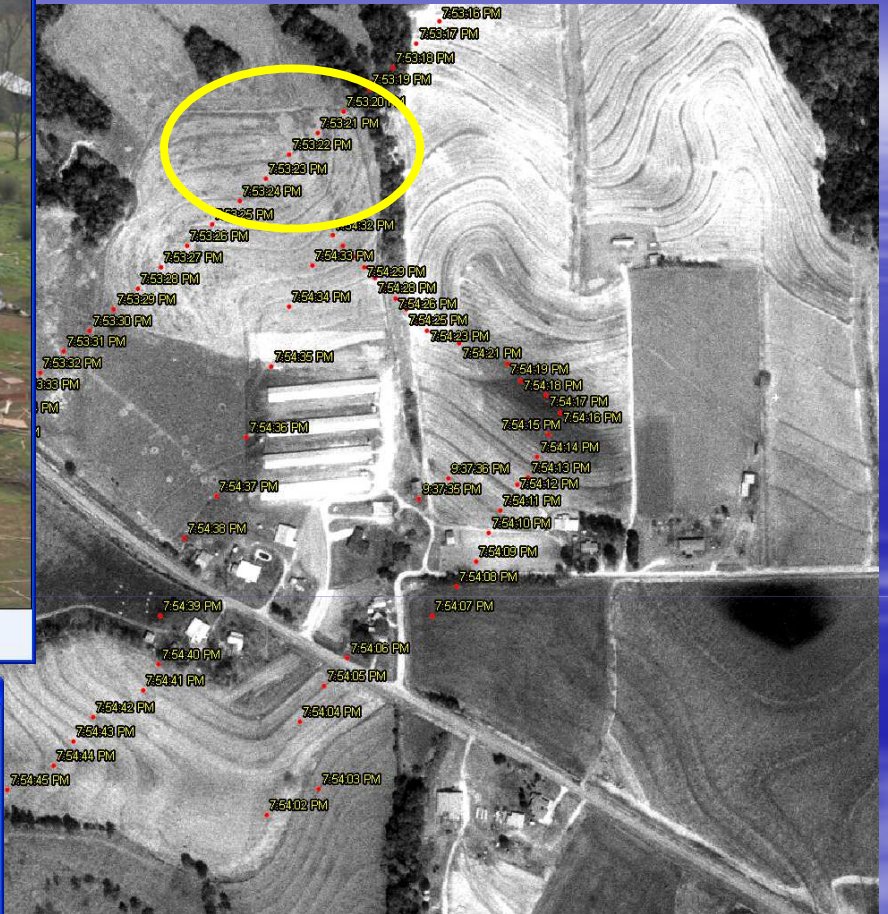
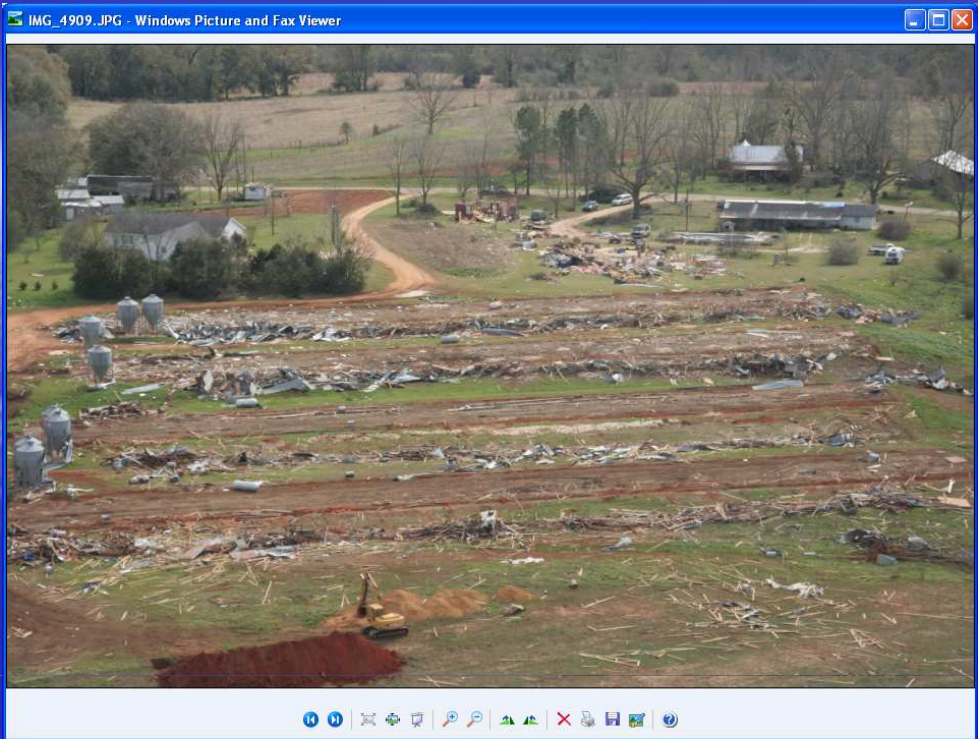
# Multiple Data Sets/Sources

- Photos – both aerial and on ground – with associated times
- GPS flight track coordinates and timestamps
- Orthoimagery from USGS
- **Fort Rucker (KEOX) Level III Radar Data from NCDC**



# Multiple Data Sets/Sources

- Photos – both aerial and on ground – with associated times
- GPS flight track coordinates and timestamps
- Orthoimagery from USGS
- Fort Rucker (KEOX) Level III Radar Data from NCDC
- **All put together in ArcGIS**



2007\_03\_04\_AL

File Edit View Favorites Tools Help

Address S:\Tornado\20070301\_Tornado\_AL\_FL\_GA\_Event\20070301\_Tornado\_Pics\_Im\_Ladue\_Survey\2007\_03\_04\_AL

Name	Size	Type	Date Modified	Date Picture Taken	Dimensions
IMG_4897.JPG	4,069 KB	JPEG Image	3/4/2007 7:16 PM	3/4/2007 6:16 PM	3456 x 2304
IMG_4898.JPG	2,879 KB	JPEG Image	3/4/2007 7:17 PM	3/4/2007 6:17 PM	3456 x 2304
IMG_4899.JPG	3,877 KB	JPEG Image	3/4/2007 7:18 PM	3/4/2007 6:18 PM	3456 x 2304
IMG_4900.JPG	3,135 KB	JPEG Image	3/4/2007 7:19 PM	3/4/2007 6:19 PM	3456 x 2304
IMG_4901.JPG	2,020 KB	JPEG Image	3/4/2007 8:32 PM	3/4/2007 7:32 PM	3456 x 2304
IMG_4902.JPG	2,064 KB	JPEG Image	3/4/2007 8:32 PM	3/4/2007 7:32 PM	3456 x 2304
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IMG_4904.JPG	3,350 KB	JPEG Image	3/4/2007 8:50 PM	3/4/2007 7:50 PM	3456 x 2304
IMG_4905.JPG	2,987 KB	JPEG Image	3/4/2007 8:50 PM	3/4/2007 7:50 PM	3456 x 2304
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IMG_4909.JPG	3,805 KB	JPEG Image	3/4/2007 8:53 PM	3/4/2007 7:53 PM	3456 x 2304
IMG_4910.aux	95 KB	AUX File	6/15/2007 9:14 AM		
IMG_4910	0 KB	JPEG Image	3/4/2007 8:53 PM	3/4/2007 7:53 PM	3456 x 2304
IMG_4910	9 KB	RRD File	6/15/2007 9:14 AM		
IMG_4911	8 KB	JPEG Image	3/4/2007 8:54 PM	3/4/2007 7:54 PM	3456 x 2304
IMG_4912.JPG	3,364 KB	JPEG Image	3/4/2007 8:56 PM	3/4/2007 7:56 PM	3456 x 2304
IMG_4913.JPG	2,688 KB	JPEG Image	3/4/2007 9:36 PM	3/4/2007 8:36 PM	3456 x 2304
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IMG_4920.JPG	4,087 KB	JPEG Image	3/4/2007 10:42 PM	3/4/2007 9:42 PM	3456 x 2304

For Each Photo...  
find points along flight  
track with  
corresponding time.

Create Damage Point  
in ArcMap with brief  
description of Damage.

The screenshot displays the ArcMap interface with the following components:

- Table of Contents:** Lists layers including 'enterprise\_damage\_major\_b', 'enterprise\_damage', and various 'GPSlogs.csv Events' and 'AL\_place' layers.
- Map View:** Shows an aerial photograph with several red dots representing damage points. Two red arrows point from the text box to these dots.
- Identify Window:** A pop-up window showing details for a selected feature. It includes a table with the following data:

Field	Value
FID	0
Shape	Point
lon	-85.9106
lat	31.2811
descriptio	Four chicken houses destroyed.
image_file	
- Taskbar:** Shows the Windows taskbar with the Start button and several open applications including Thunderbird, NOGAPS Sea Level Pr..., enterprise\_tor.mxd, Small\_Pics, NWA Presentation, and Microsoft PowerPoint.



# Subjective Determination of Major vs. Minor Damage

enterprise\_tor.mxd - ArcMap - ArcView

File Edit View Insert Selection Tools Window Help

1:2,079

Editor Task: Create New Feature Target: Geostatistical Analyst Publisher

Enterprise Overview

- enterprise\_damage\_major\_b
- enterprise\_damage
- 20070304GPSlogs.csv Events
- 20070305GPSlogs.csv Events
- 20070306GPSlogs.csv Events
- AL\_place
- AL\_Airports
- fl\_ga\_al\_tiger\_roads
- AL\_Rail100k
- AL\_Runway
- KEOX\_NOS\_20070301\_1910
- KEOX\_NOS\_20070301\_1915
- KEOX\_NOS\_20070301\_1920
- KEOX\_NOR\_20070301\_1920
- KEOX\_NOR\_20070301\_1915
- KEOX\_NOR\_20070301\_1910
- KEOX\_NOR\_20070301\_1905
- KEOX\_NOR\_20070301\_1900
- KEOX\_NOR\_20070301\_1855

Display Source Selection

ArcToolbox

- 3D Analyst Tools
- Analysis Tools
- Cartography Tools
- Conversion Tools
- Data Interoperability Tools
- Data Management Tools
- Geocoding Tools
- Geostatistical Analysis Tools
- Linear Referencing Tools
- Network Analysis Tools
- Samples
- Spatial Analyst Tools
- Spatial Statistics Tools

Identify

Identify from: <Top-most layer>

- enterprise\_damage\_major\_b
- Frame home completely destroyed

Field	Value
FID	40
Shape	Point
lon	0
lat	0
descriptio	Frame home completely destroyed.
image_file	

Identified 1 feature

Favorites Index Search Results

Drawing Arial 10 B I U

start

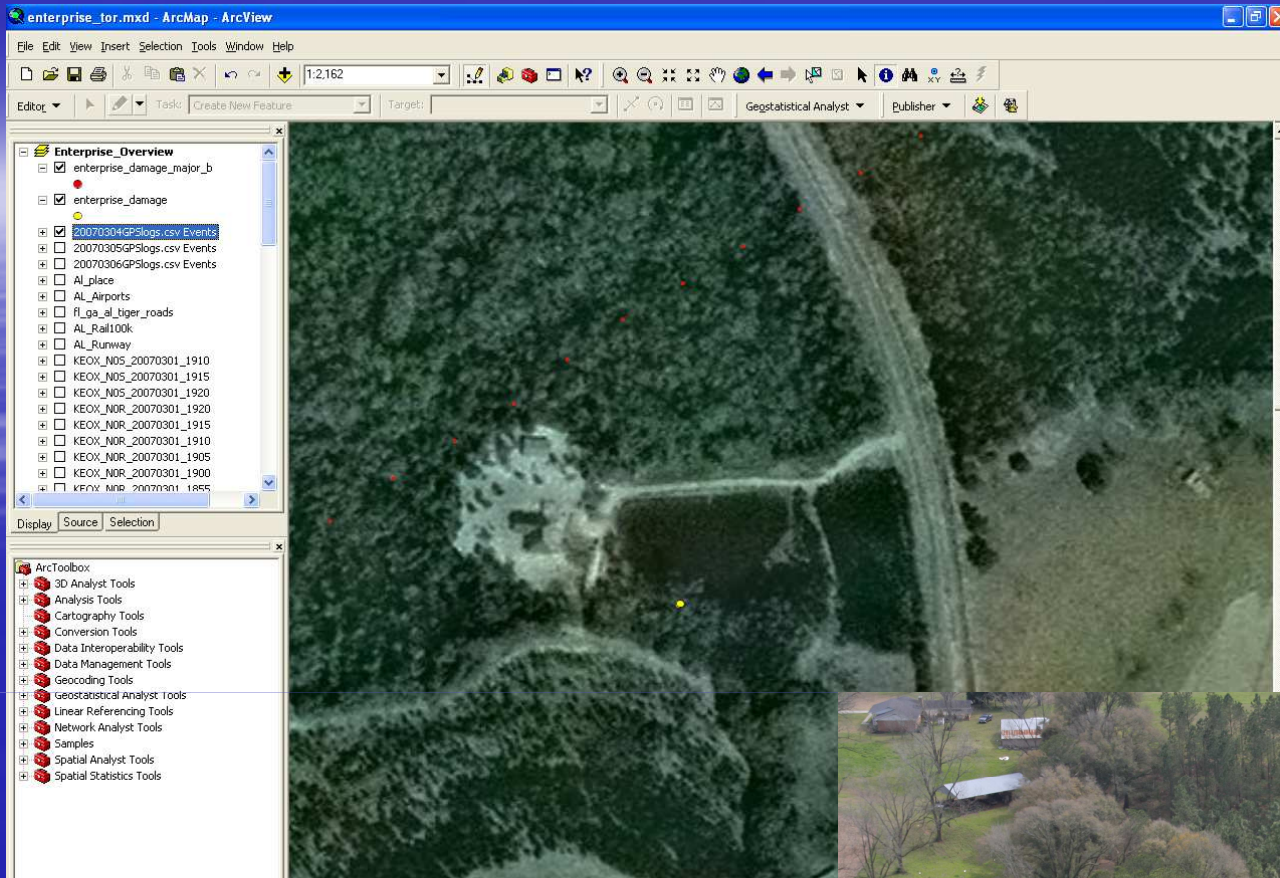
Inbox - Thunde... FTP directory /p... enterprise\_tor... My Documents



**If a tree falls in the forest...**

**How do you know  
where it is???**





Match flight track time to photograph...then features in photograph with features in orthoimagery.



enterprise\_tor.mxd - ArcMap - ArcView

File Edit View Insert Selection Tools Window Help

1:56,053

Task: Create New Feature Target:

Layers: <Top-most layer>

Layers:

- enterprise\_damage
  - Home destroyed.
  - Home Destroyed.
  - Roof missing.
  - Severe Roof Damage.
  - Roof missing.
  - Roof Damage.
- 20070101
- 20070101
- 20070101
- milenk
- AL\_plac
- AL\_Air
- fl\_ga\_
- funclas
- majrds
- AL\_Waterway
- AL\_Rail100k
- AL\_Nhpnlin
- RoadCenterline
- AL\_Runway
- rcharg
- surgeo
- AL\_Hydropoly
- AL\_Park
- AL\_boc\_uza
- Al\_State

Location: (-85.869530 31.311404)

Field	Value
FID	24
Shape	Point
lon	0
lat	0
descriptio	Home destroyed.
image_file	

Analysis Tools  
 Cartography Tools  
 Conversion Tools  
 Data Interoperability Tools  
 Quick Export  
 Quick Import  
 Data Management Tools  
 Database  
 Domains  
 Feature class  
 Features  
 Fields  
 General  
 Append  
 Copy  
 Delete  
 Merge  
 Rename  
 Select Data  
 Generalization  
 Indexes  
 Trunc

Display Source Selection

Drawing Arial 10 B I U 100%

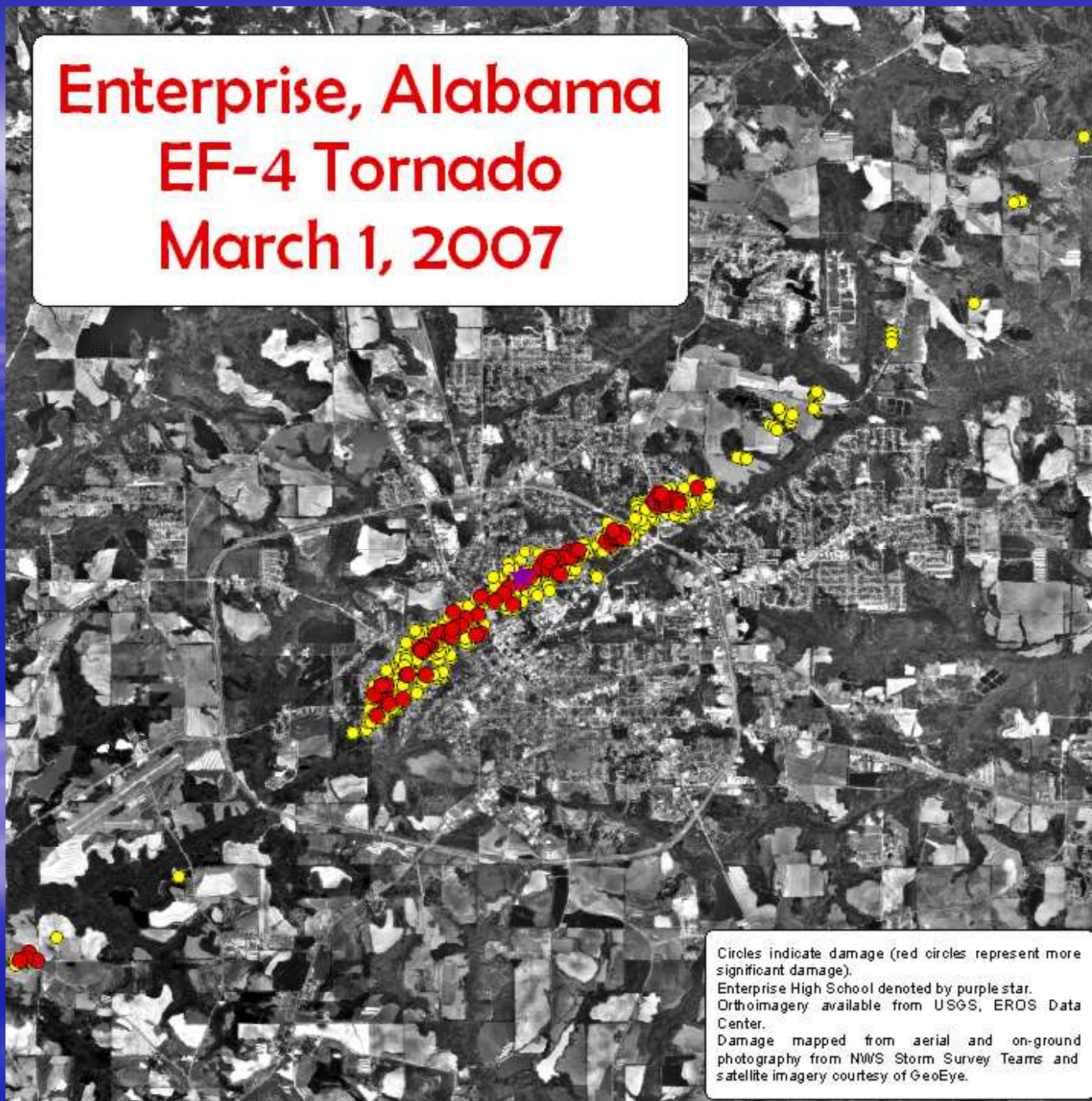
10444961.08 3812488.53 Yard

start | Inbox - Thunderbird | enterprise, al - Googl... | enterprise\_tor.mxd - ... | 20070301\_Tornado... | Images | 12:40 PM

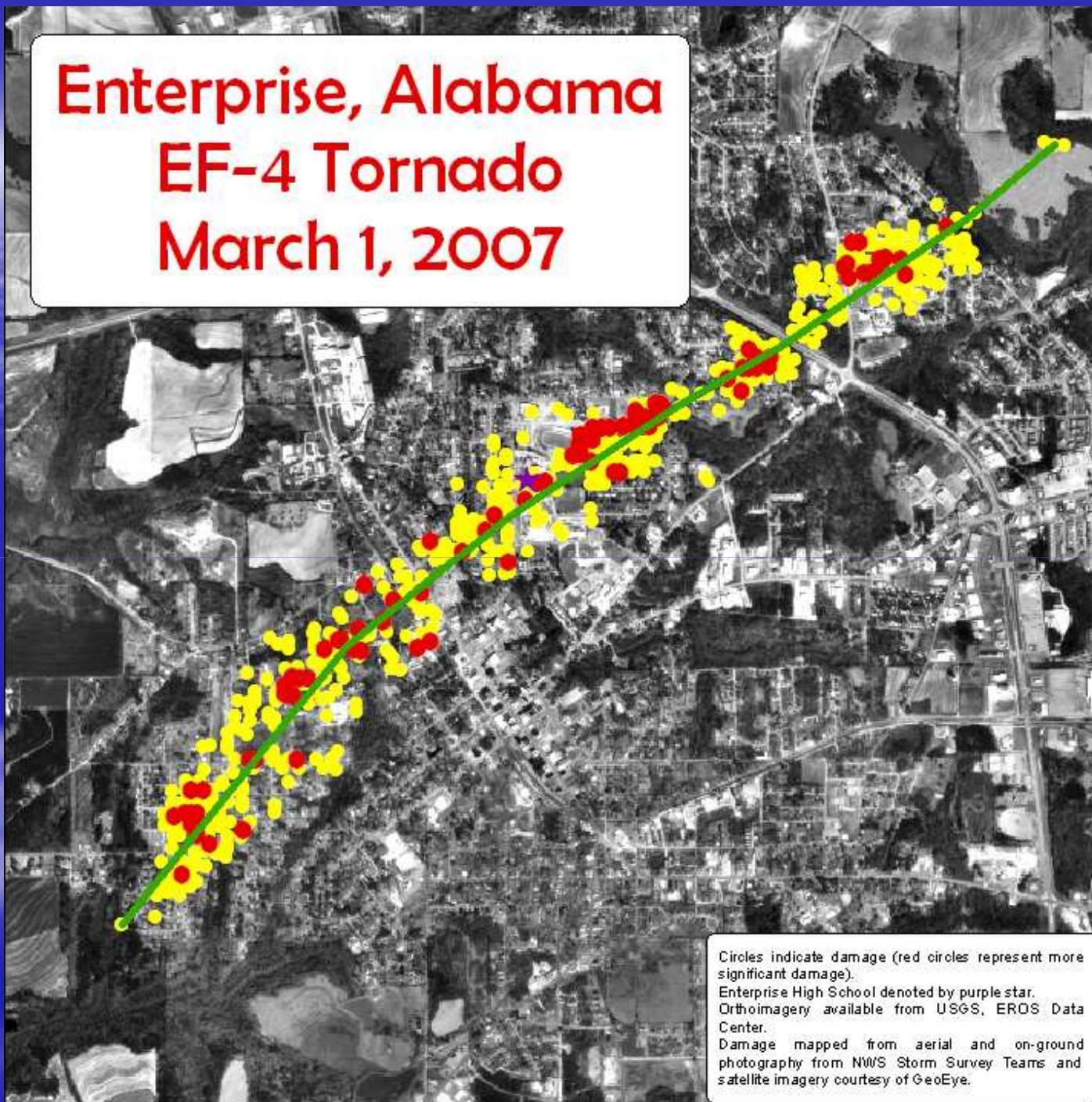
# Enterprise, Alabama

## EF-4 Tornado

### March 1, 2007

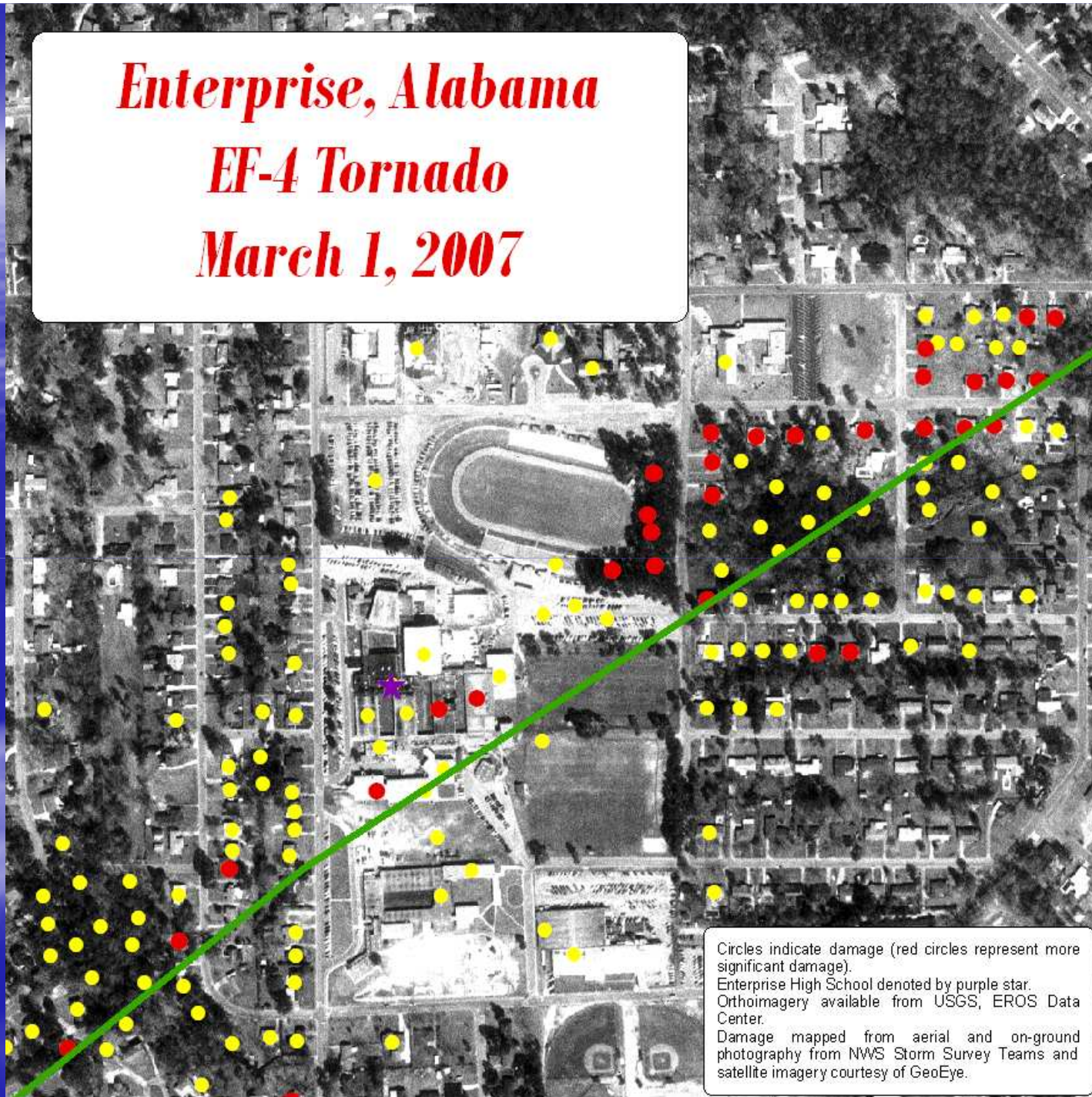


# Enterprise, Alabama EF-4 Tornado March 1, 2007



Circles indicate damage (red circles represent more significant damage).  
Enterprise High School denoted by purple star.  
Orthoimagery available from USGS, ERDS Data Center.  
Damage mapped from aerial and on-ground photography from NWS Storm Survey Teams and satellite imagery courtesy of GeoEye.

*Enterprise, Alabama*  
*EF-4 Tornado*  
*March 1, 2007*



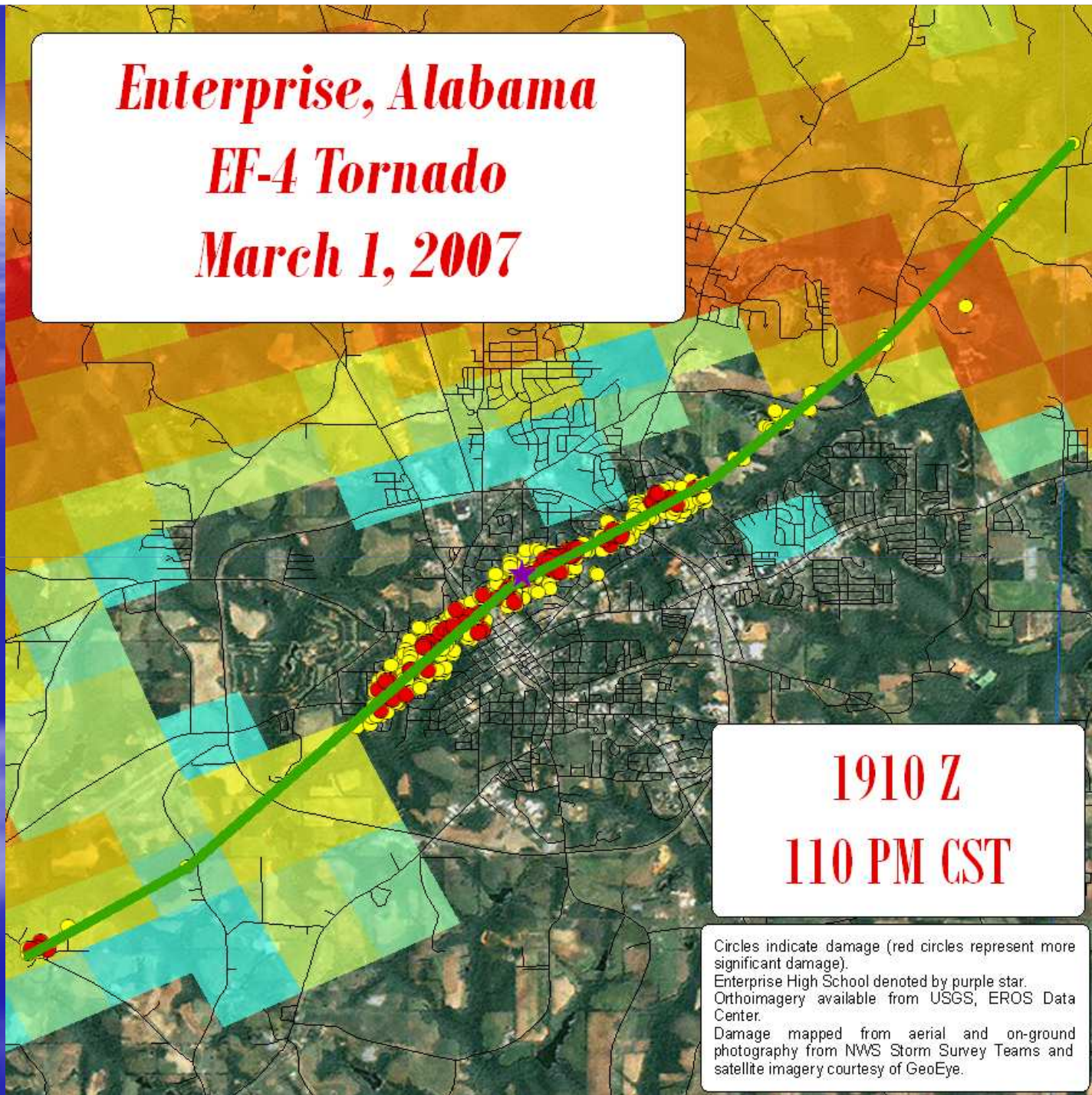
Circles indicate damage (red circles represent more significant damage).  
Enterprise High School denoted by purple star.  
Orthoimagery available from USGS, EROS Data Center.  
Damage mapped from aerial and on-ground photography from NWS Storm Survey Teams and satellite imagery courtesy of GeoEye.





# Comparing Damage Swath to Radar Data

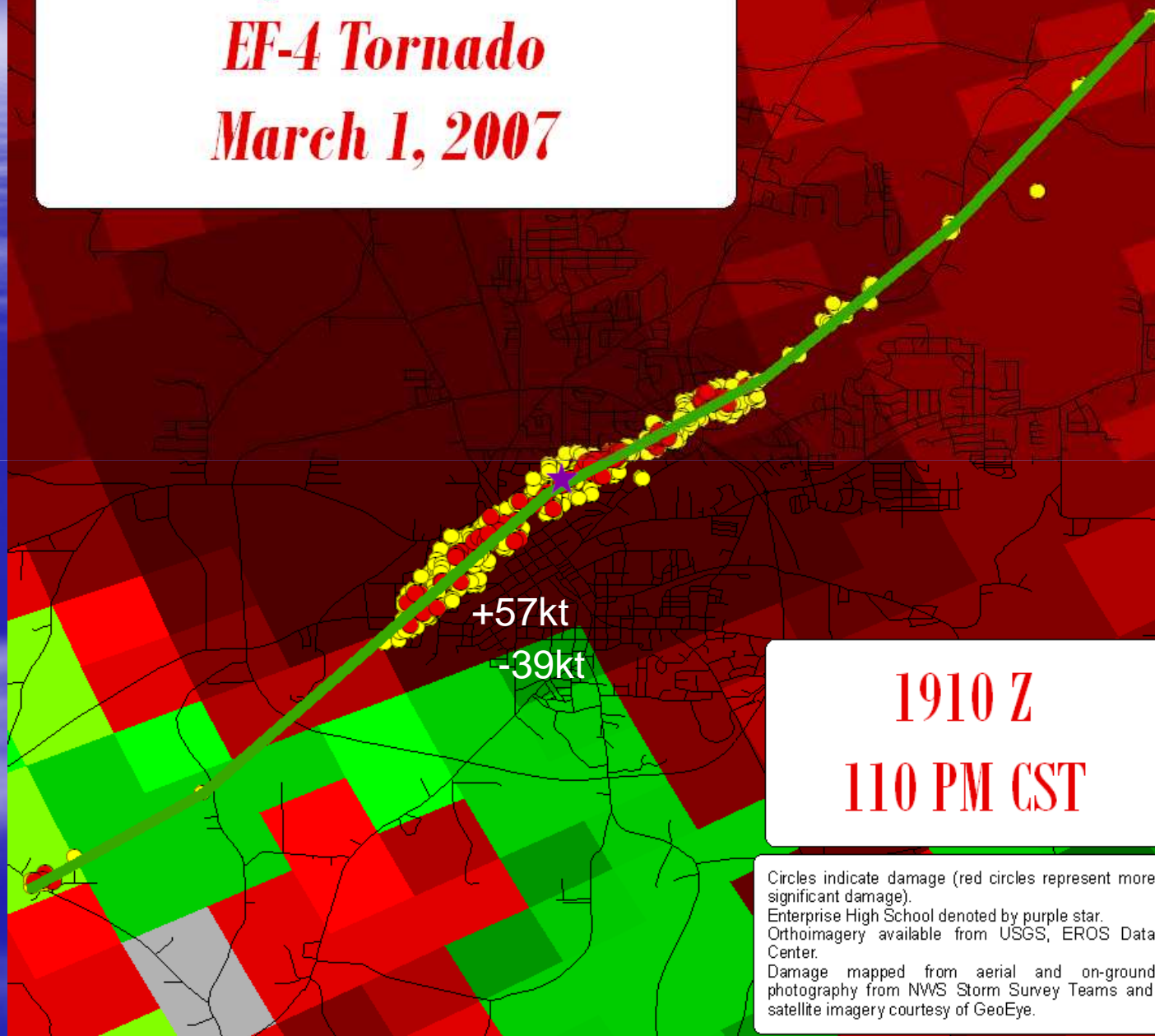
***Enterprise, Alabama***  
***EF-4 Tornado***  
***March 1, 2007***



# *Enterprise, Alabama*

## *EF-4 Tornado*

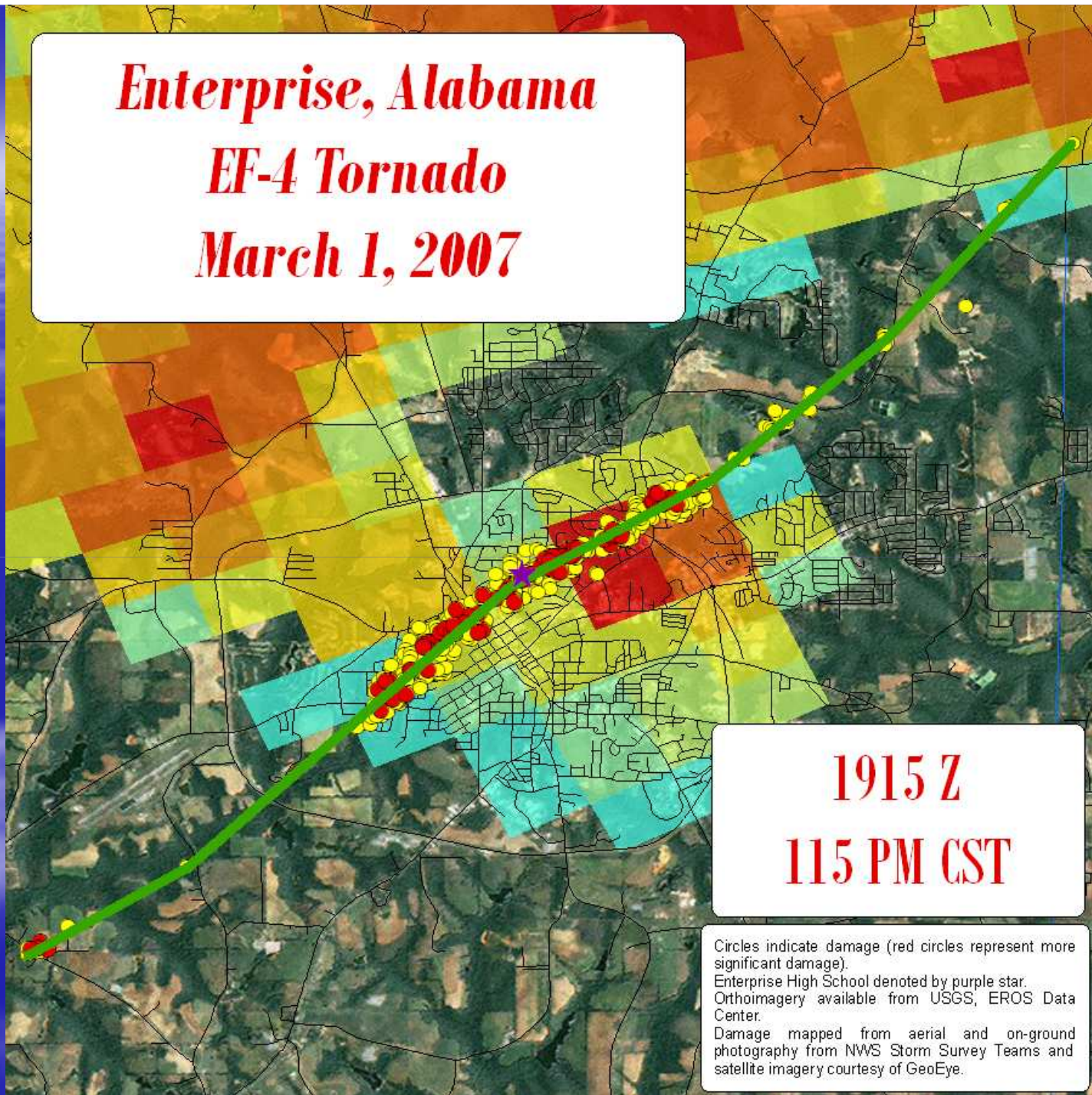
### *March 1, 2007*



**1910 Z**  
**110 PM CST**

Circles indicate damage (red circles represent more significant damage).  
Enterprise High School denoted by purple star.  
Orthoimagery available from USGS, EROS Data Center.  
Damage mapped from aerial and on-ground photography from NWS Storm Survey Teams and satellite imagery courtesy of GeoEye.

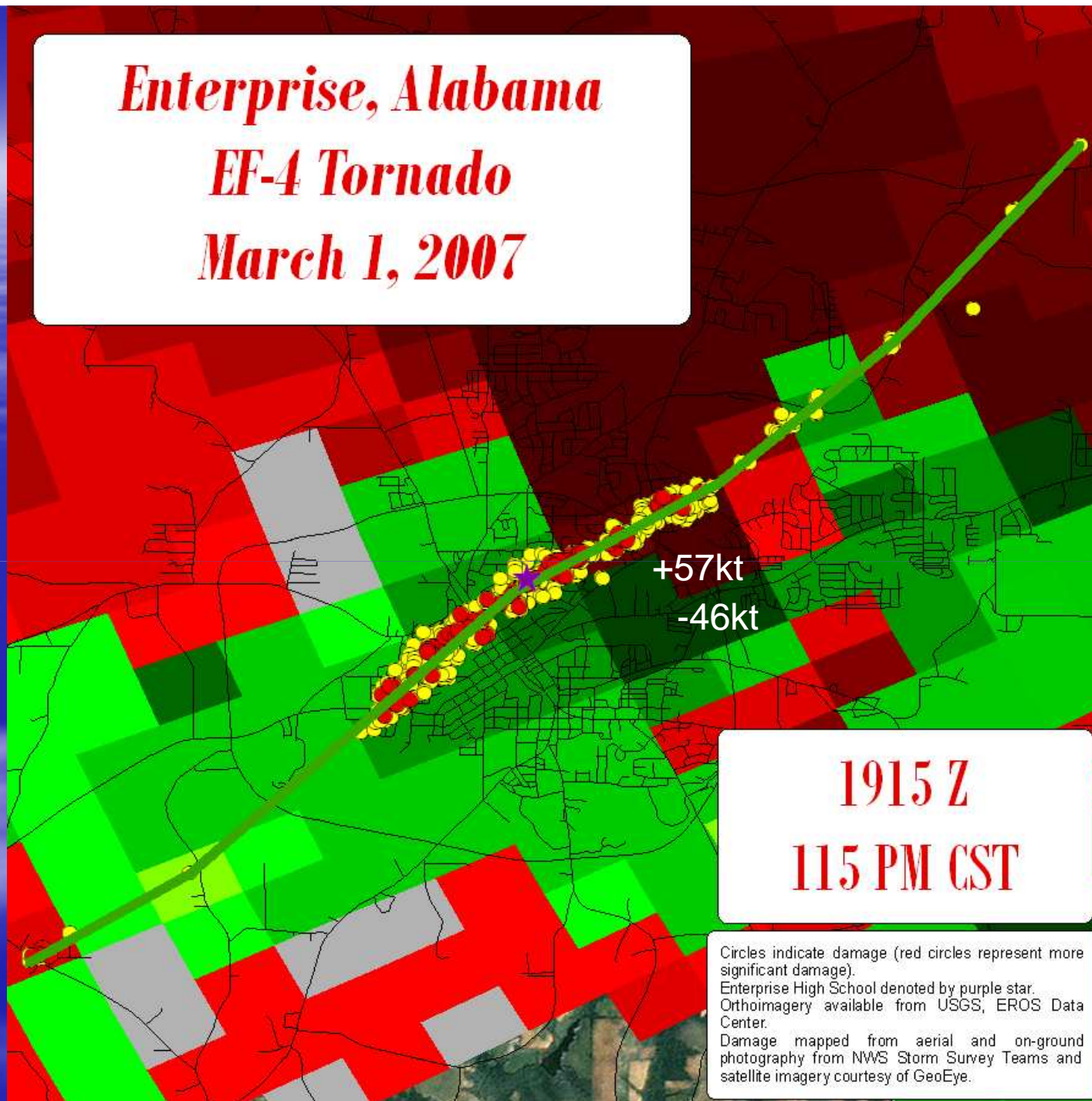
***Enterprise, Alabama***  
***EF-4 Tornado***  
***March 1, 2007***



# *Enterprise, Alabama*

## *EF-4 Tornado*

### *March 1, 2007*

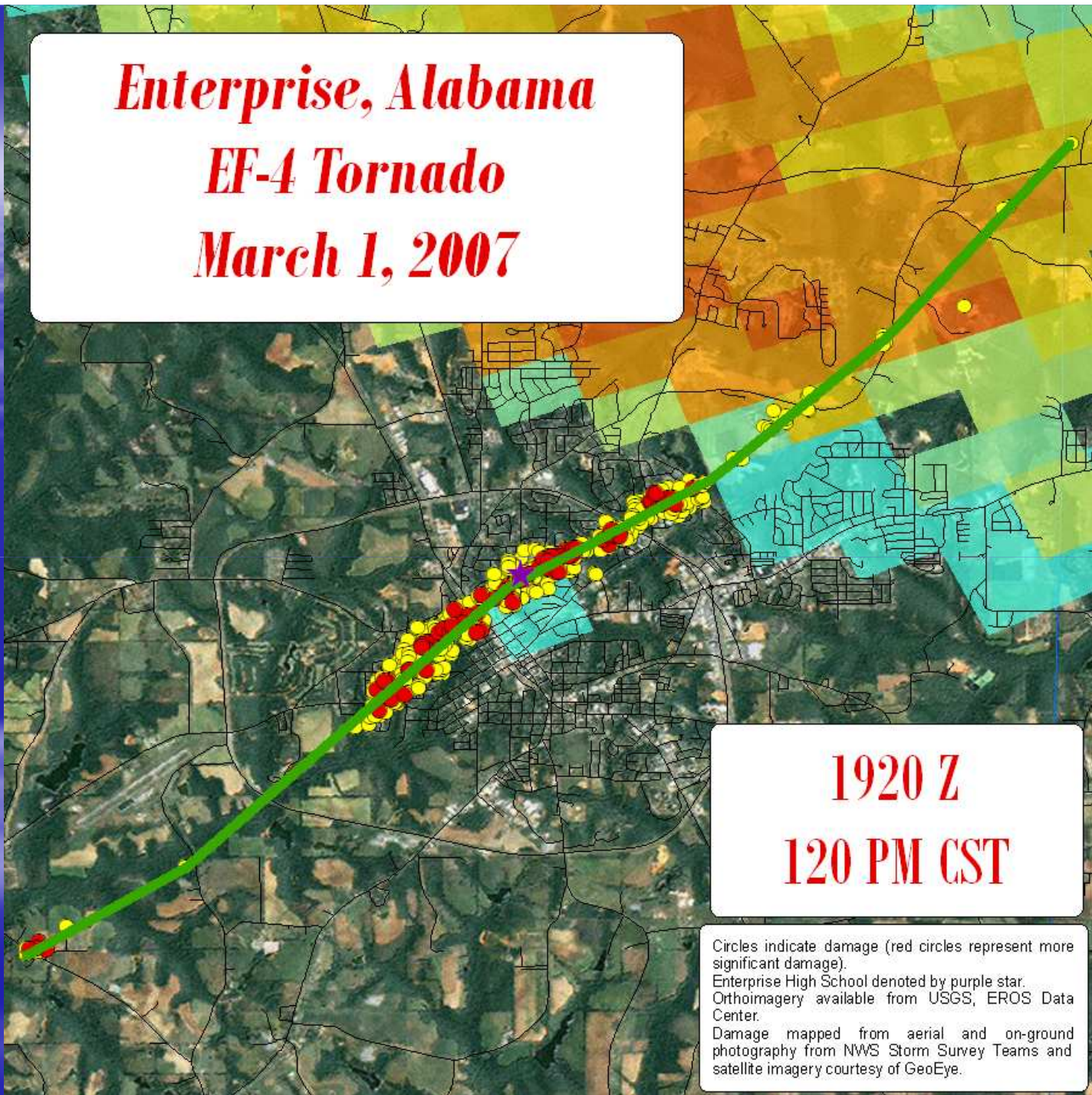


**1915 Z**

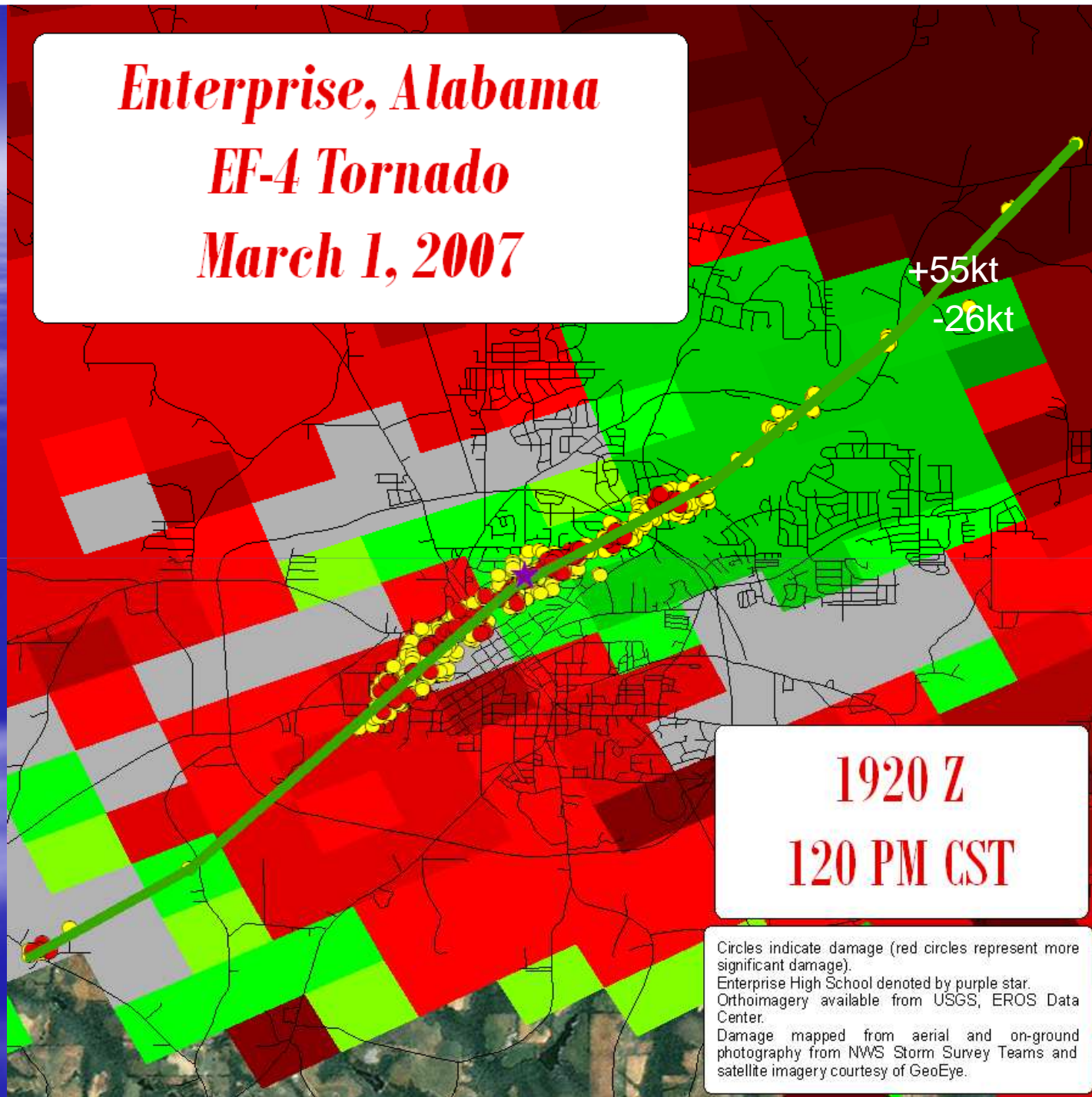
**115 PM CST**

Circles indicate damage (red circles represent more significant damage).  
Enterprise High School denoted by purple star.  
Orthoimagery available from USGS, EROS Data Center.  
Damage mapped from aerial and on-ground photography from NWS Storm Survey Teams and satellite imagery courtesy of GeoEye.

***Enterprise, Alabama***  
***EF-4 Tornado***  
***March 1, 2007***



***Enterprise, Alabama***  
***EF-4 Tornado***  
***March 1, 2007***



# Summary

- GIS software allows for integration of multiple data sets
- Detailed Spatial View of Storm Damage
- Analysis of damage vs. radar



# Acknowledgements

- Photographs
  - Bob Duggans – NWS Tallahassee
  - Jim Ladue – Warning Decision Training Branch
- GIS Data
  - USGS
  - ESRI
  - NCDC