

# Monitoring Student Movements With GPS

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# Scope of Presentation

- Use of GPS to monitor student movements in a surveying course
  - Completion of field laboratory exercises
  - Student preparation
  - Efficient use of time
  - Adequate in class training
  - Evaluate instructor expectations



# Surveying in the Curriculum

- Part of the major in Geospatial Information Science
  - 30 course core curriculum
  - 2 elective courses
  - 1 integrative experience course
  - 7 courses within the major
    - Computer Cartography
    - Geographic Information Systems
    - Advanced Geographic Information Systems
    - Remote Sensing
    - Advanced Remote Sensing
    - Photogrammetry
    - Surveying

# Surveying at West Point

- Taught continuously since 1802
- 40 lessons with 22 laboratory periods
- Modern surveying course covering:
  - Error theory
  - Horizontal distance
  - Angle measurements
  - Closed traverse
  - Horizontal curves
  - RTK GPS
  - Topographic & site surveys



# Student Laboratory Issues

- TIME!!!!!!
  - Consistent complaint “Not enough time to complete field laboratory exercises!”
- Classroom preparation
  - Lecture on concepts & theory
  - In class equipment setup
  - Equipment setup cheat sheets
  - Mission planning worksheet



# Instructor Laboratory Observations

- Preparation, preparation, preparation (or lack thereof)!!!!
  - Much ado about nothing
  - Chicken with head cut off syndrome
- Solution?



# Monitoring Student Movements

- Automated method to track student movements
  - Wildlife tagging with GPS receivers
  - Positional information
  - “Time on target” information
  - Garmin Forerunner 305



# Experimental Design

- Garmin Forerunner 305s issued to 2 crews
  - rod person
  - equipment (total station) person
  - note taker
- Data Collected
  - position every five seconds
  - time stamp for every position
- Analysis
  - shape files for spatial movement documentation
  - time stamp for temporal documentation



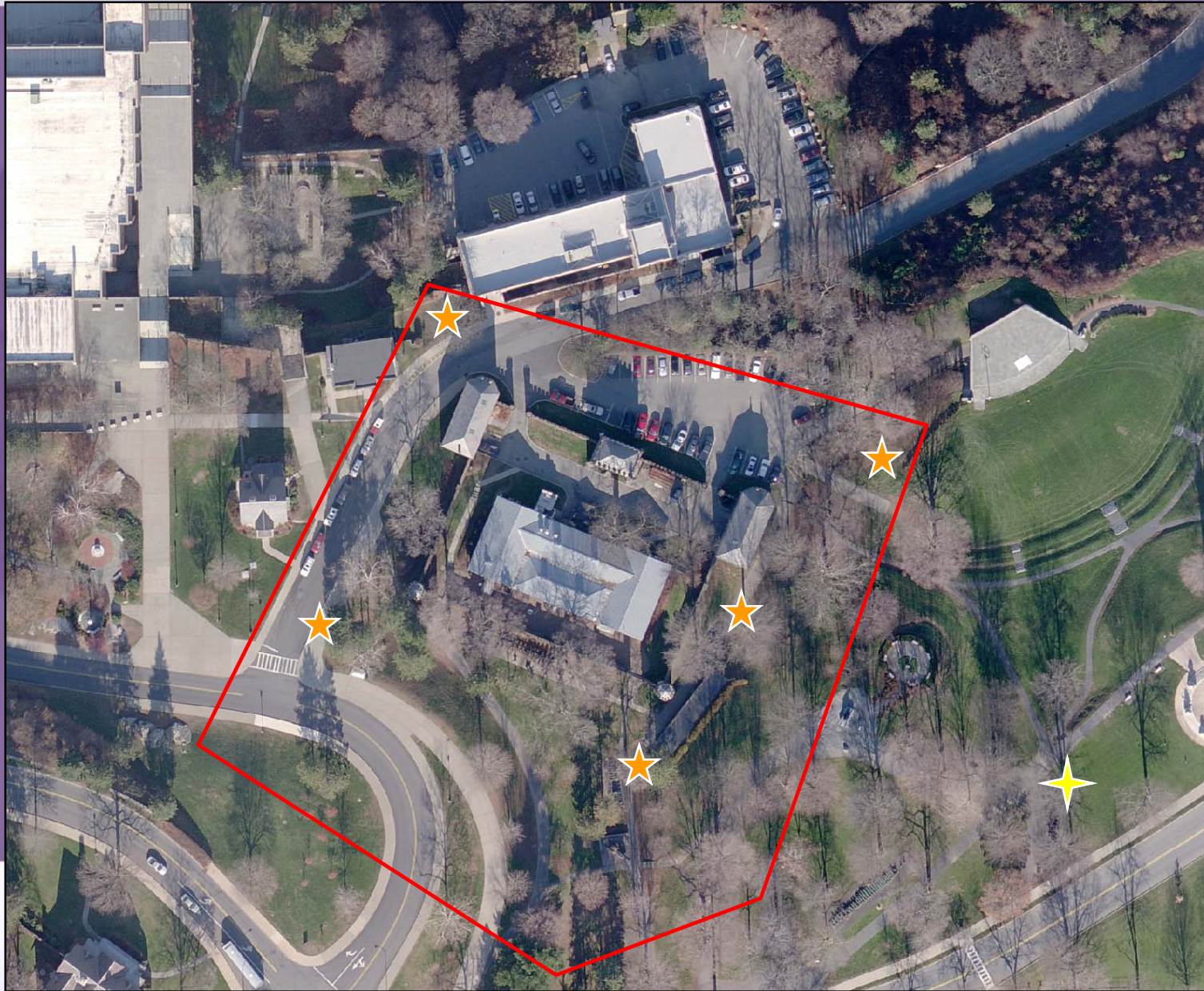


# Experimental Design - Project

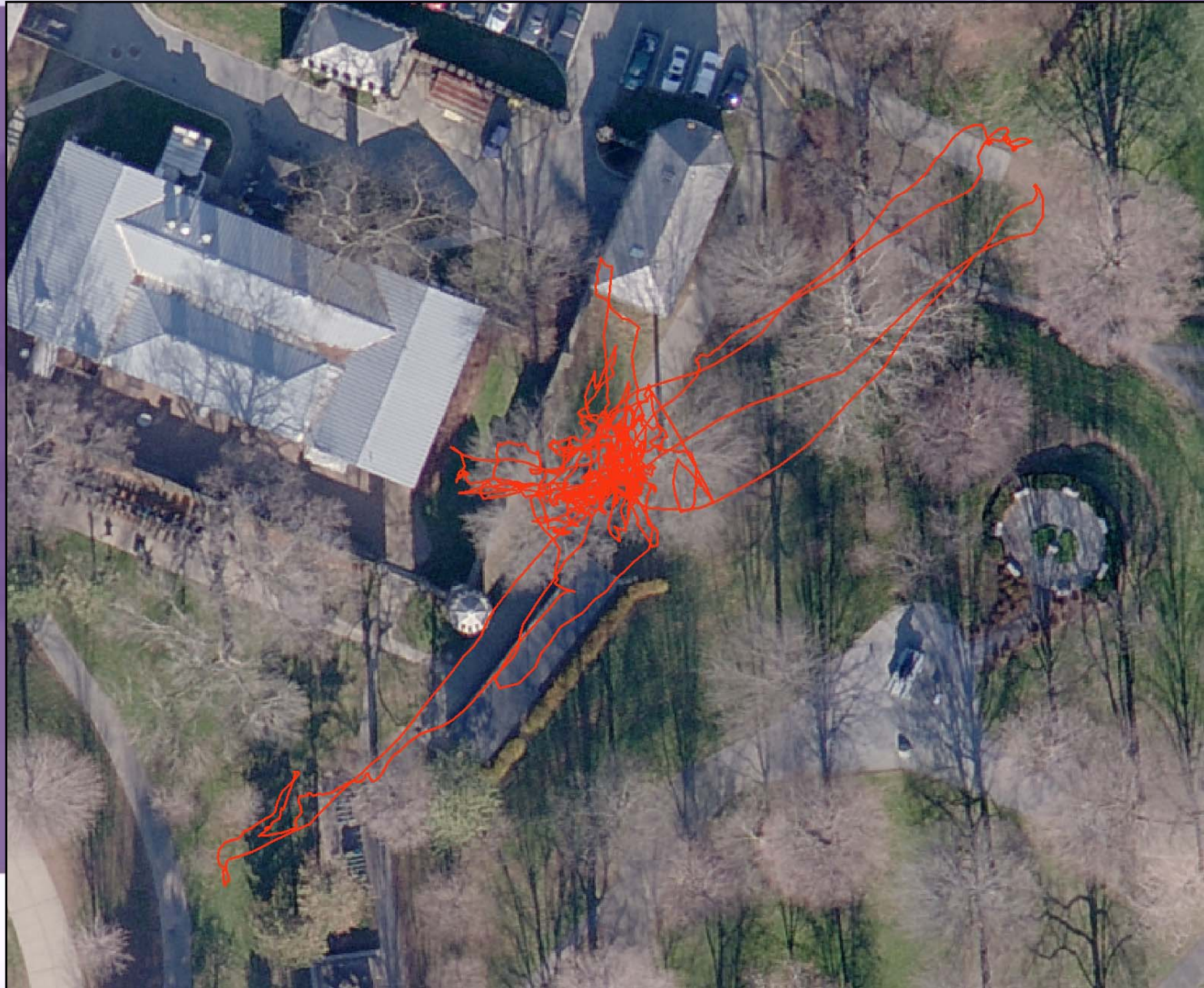
- Firsty Club Site Survey
  - X, Y, and Z data for:
    - buildings
    - other man mad features
    - vegetative features
    - topographic points for contouring



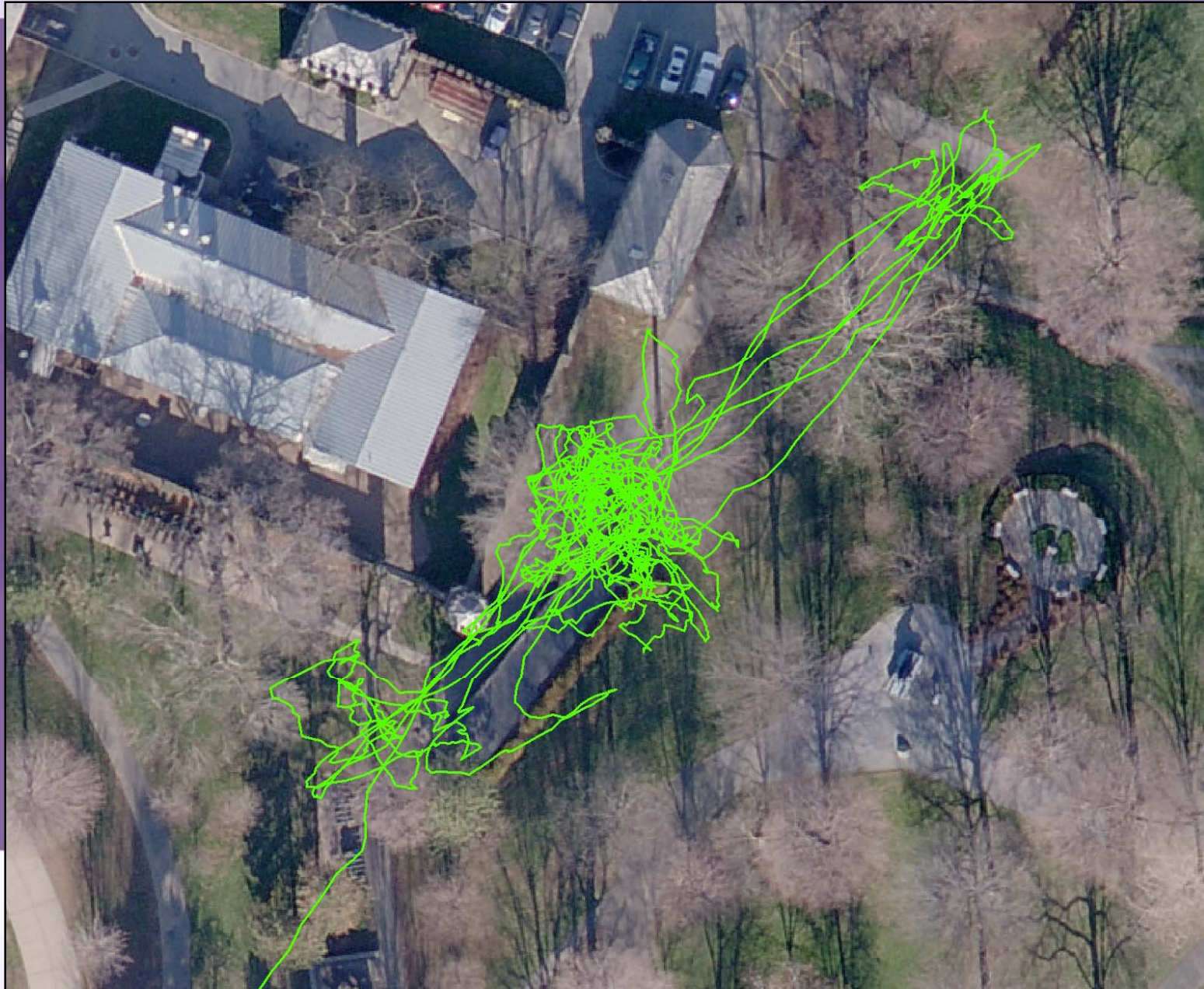
# Experimental Design – Study Site



# Data Acquisition - Analysis of Shapefiles



# Data Acquisition - Analysis of Shapefiles



# Data Acquisition – Analysis of Time Data

Attributes of 006\_points

FID	Shape *	TYPE	IDENT	LAT	LONG	Y_PROJ	X_PROJ	NEW_SEG	DISPLAY	COLOR	ALTITUDE	DEPTH	TEMP	TIME	MODEL
0	Point	TRACK		41.395075	-73.958213	41.395075	-73.958213	False	False	0	0	0	0	2007/11/29-19:23:20	Forerunner305
1	Point	TRACK		41.395059	-73.958205	41.395059	-73.958205	False	False	0	0	0	0	2007/11/29-19:23:21	Forerunner305
2	Point	TRACK		41.395053	-73.958202	41.395053	-73.958202	False	False	0	0	0	0	2007/11/29-19:23:22	Forerunner305
3	Point	TRACK		41.395053	-73.958202	41.395053	-73.958202	False	False	0	0	0	0	2007/11/29-19:23:23	Forerunner305
4	Point	TRACK		41.395051	-73.958201	41.395051	-73.958201	False	False	0	0	0	0	2007/11/29-19:23:24	Forerunner305
5	Point	TRACK		41.39505	-73.958201	41.39505	-73.958201	False	False	0	0	0	0	2007/11/29-19:23:25	Forerunner305
6	Point	TRACK		41.395047	-73.958199	41.395047	-73.958199	False	False	0	0	0	0	2007/11/29-19:23:26	Forerunner305
7	Point	TRACK		41.395047	-73.958199	41.395047	-73.958199	False	False	0	0	0	0	2007/11/29-19:23:27	Forerunner305
8	Point	TRACK		41.395044	-73.958197	41.395044	-73.958197	False	False	0	0	0	0	2007/11/29-19:23:28	Forerunner305
9	Point	TRACK		41.395043	-73.958196	41.395043	-73.958196	False	False	0	0	0	0	2007/11/29-19:23:29	Forerunner305
10	Point	TRACK		41.395028	-73.958185	41.395028	-73.958185	False	False	0	0	0	0	2007/11/29-19:23:30	Forerunner305
11	Point	TRACK		41.39502	-73.958177	41.39502	-73.958177	False	False	0	0	0	0	2007/11/29-19:23:31	Forerunner305
12	Point	TRACK		41.39501	-73.958172	41.39501	-73.958172	False	False	0	0	0	0	2007/11/29-19:23:32	Forerunner305
13	Point	TRACK		41.395007	-73.958172	41.395007	-73.958172	False	False	0	0	0	0	2007/11/29-19:23:33	Forerunner305
14	Point	TRACK		41.394996	-73.958171	41.394996	-73.958171	False	False	0	0	0	0	2007/11/29-19:23:34	Forerunner305
15	Point	TRACK		41.394987	-73.958174	41.394987	-73.958174	False	False	0	0	0	0	2007/11/29-19:23:35	Forerunner305
16	Point	TRACK		41.394975	-73.95817	41.394975	-73.95817	False	False	0	0	0	0	2007/11/29-19:23:36	Forerunner305
17	Point	TRACK		41.394965	-73.958167	41.394965	-73.958167	False	False	0	0	0	0	2007/11/29-19:23:37	Forerunner305
18	Point	TRACK		41.394956	-73.958164	41.394956	-73.958164	False	False	0	0	0	0	2007/11/29-19:23:38	Forerunner305
19	Point	TRACK		41.394946	-73.958159	41.394946	-73.958159	False	False	0	0	0	0	2007/11/29-19:23:39	Forerunner305
20	Point	TRACK		41.39494	-73.958157	41.39494	-73.958157	False	False	0	0	0	0	2007/11/29-19:23:40	Forerunner305
21	Point	TRACK		41.394929	-73.958153	41.394929	-73.958153	False	False	0	0	0	0	2007/11/29-19:23:41	Forerunner305
22	Point	TRACK		41.394927	-73.95815	41.394927	-73.95815	False	False	0	0	0	0	2007/11/29-19:23:42	Forerunner305

Record: 1 Show: All Selected Records (0 out of 13649 Selected) Options

# Analysis

- Shapefiles
  - Show “huddles” near a set up station
  - Show efficiency or inefficiency of data collection at x,y,z points
- Temporal Data
  - Inefficiency and confusion at beginning of the exercise
  - Success once set up and “planning” is complete
  - Inefficiency and confusion decreases with each successive set up station
- Shapefile & Temporal Data Integration

# Conclusions

- @#\*%& Students!!!
  - Project planning
  - Familiarization with equipment
- @#\*%& Instructors!!!
  - Inadequate emphasis on project planning
  - Not enough time to become familiar with equipment
- Solution
  - Don't expect all students to police themselves
  - Lab practical on setup and utilization of equipment
  - Preliminary project plan to be turned in prior to lab exercise