COE CST Fifth Annual Technical Meeting

TASK 332-SIM/SU: Assessing rural airports for drone and RLV use using the Draper-Santos projection methodology

Prof. Aaron Santos, Dr. Chris Draper, Kristina Smith, Nick Joslyn, and Mackenzie Finnegan

October 27-28, 2015
Arlington, VA

Center of Excellence for Commercial Space Transportation

Agenda

- Team Members
- Task Description
- Schedule
- Goals
- Results
- Conclusions and Future Work

Team Members

- People


  - Prof. Aaron Santos, Dr. Chris Draper,



  - Kristina Smith, Nick Joslyn, and Mackenzie Finnegan

- Organizations

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Task Description

- Determine which rural airports are suitable for supporting RLV and drone operations based on the proximity and density of population centers.
  - Use the Draper-Santos projection methodology to develop airspace volumes where unrestricted vehicle operation will not unreasonably endanger the public
  - Examine population clustering and sheltering model strategies that ensure suitable data fidelity in rural or sparsely populated areas
  - Integrate Stanford tools RSAT and SU-FARM to increase efficiency of analysis
  - Assess how specific results could be used to benefit FAA regulatory activities

Schedule

- The near term tasks and target completion dates are as follows:

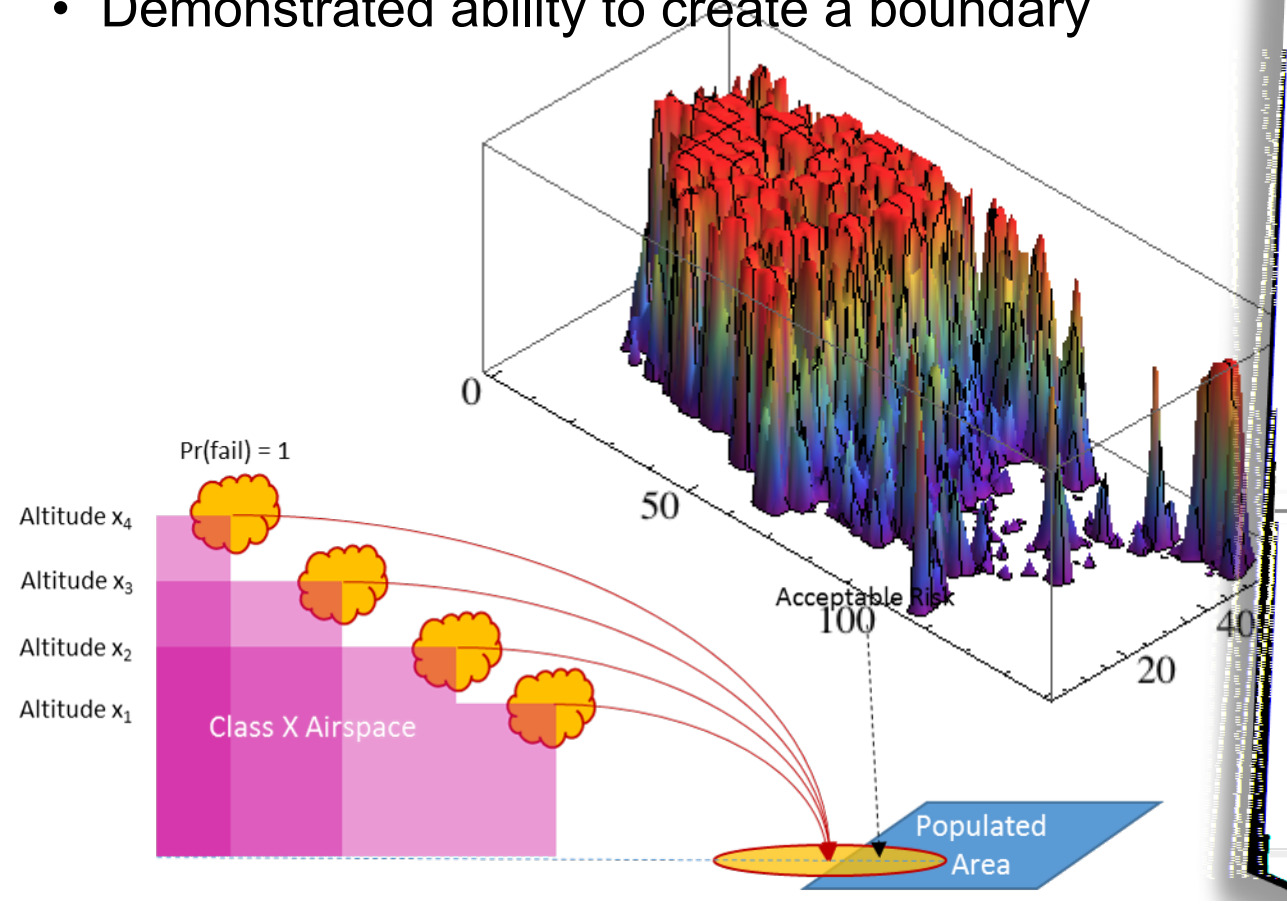
	Start	Target
Assessment of accessible population data sources	1JUN15	15DEC15
Examination of population cluster modelling strategies	1AUG15	15APR15
Development of population data around test site	1NOV15	15DEC15
Development of catastrophic risk assessment for test site	1DEC15	15DEC15
Integration of catastrophic risk assessment into Draper-Santos projection model	15JAN16	30MAY16
Application of catastrophe-based Draper-Santos model to multiple test locations	15APR16	30MAY16
Examination of Stanford tool integration	1JUN16	1OCT16

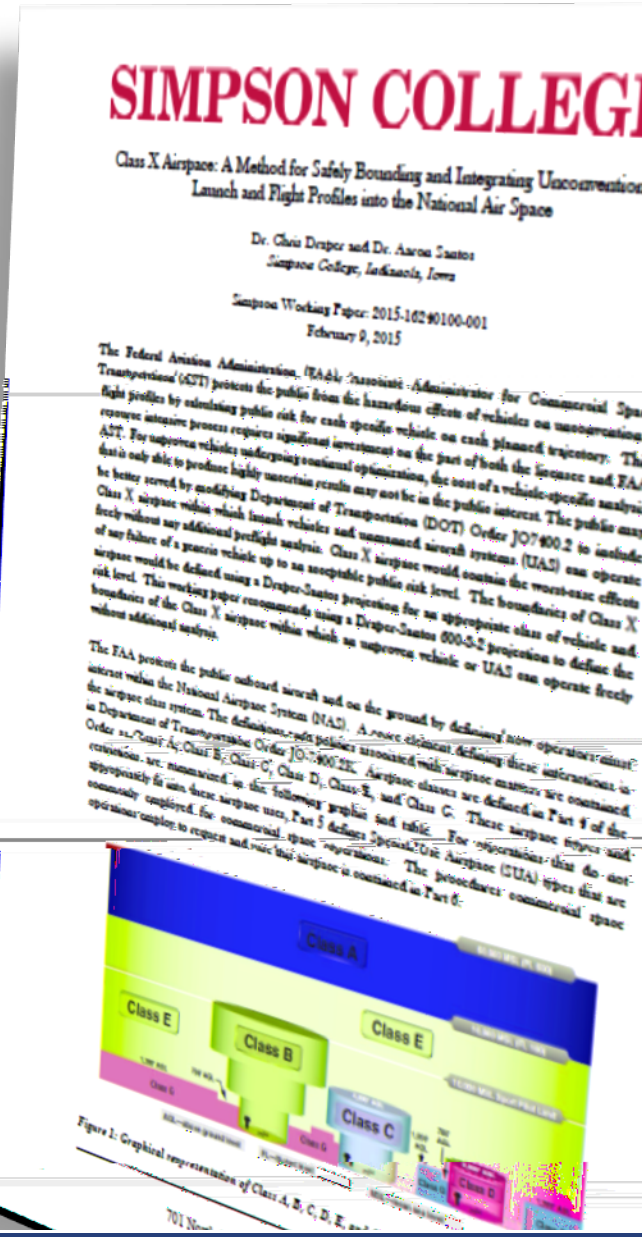
Goals

- Goal:
  - Demonstrate that a risk-based flight envelope designed to containing any hazards from unconventional launch profiles can be efficiently built for rural areas
- Relevance to Commercial Space Industry:
  - Demonstrating that we can identify volumes of airspace where any failure will not violate an appropriate level of safety means we can remove mission-specific restrictions for RLV and UAS tests or missions operating in these volumes

Results: Concept

- Created MVP
- Ran census-level populations
- Demonstrated ability to create a boundary

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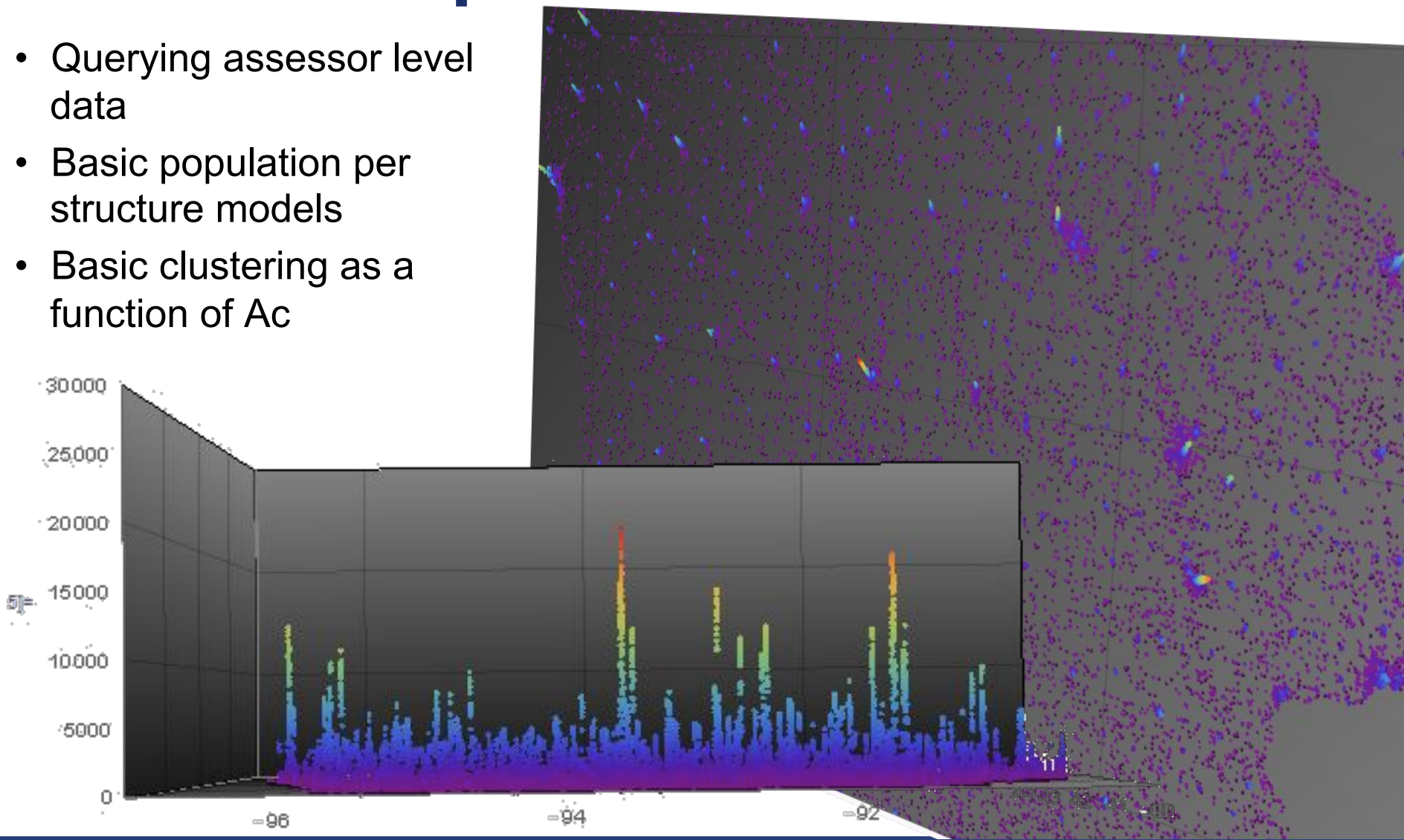
Class X Airspace: A Method for Safely Bounding and Integrating Unconventional Launch and Flight Profiles into the National Air Space

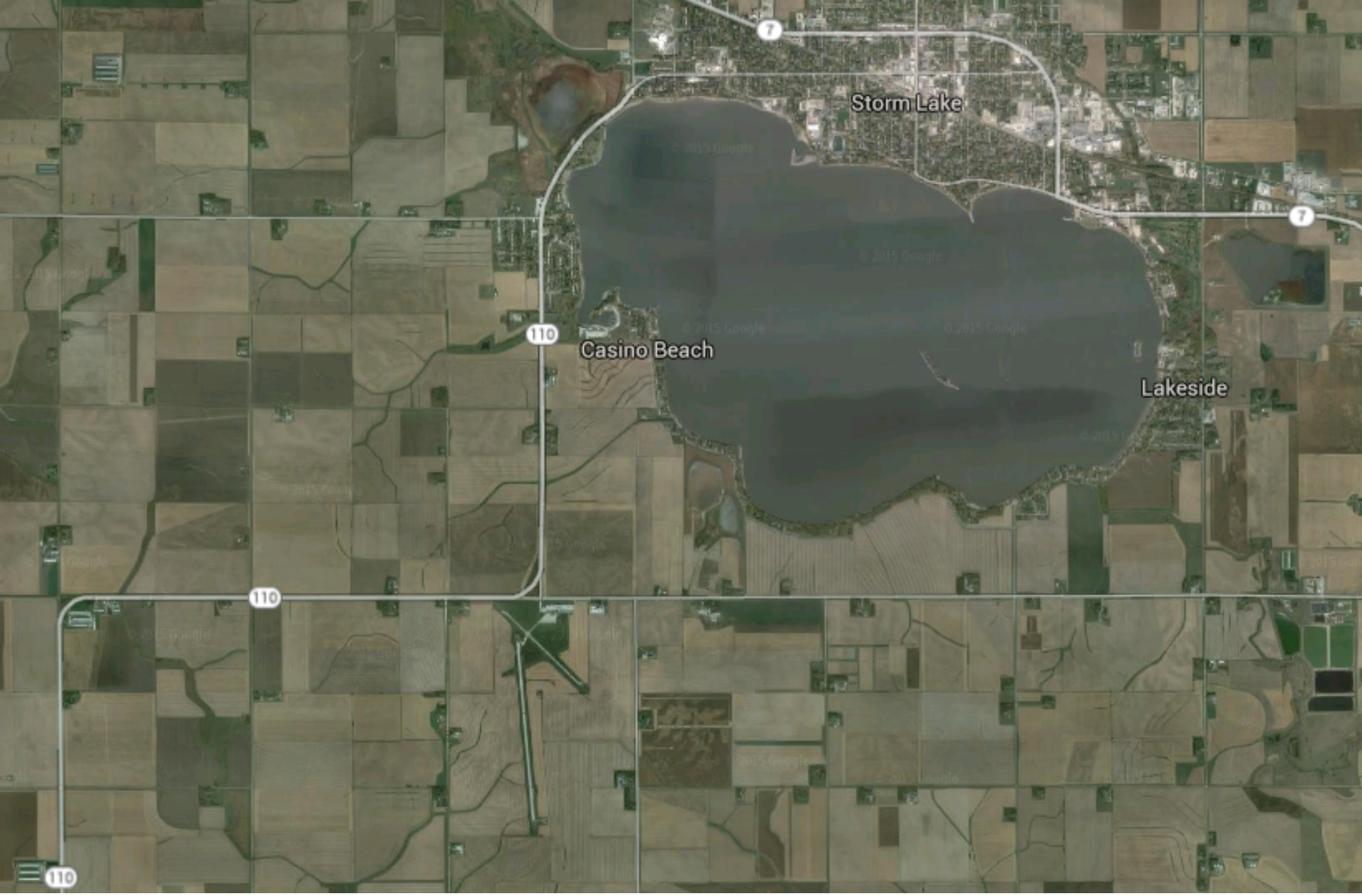
Dr. Chris Draper and Dr. Aaron Santos
Simpson College, Indianola, Iowa

Simpson Working Paper: 2015-102#0100-001
February 9, 2015

Results: Population

- Querying assessor level data
- Basic population per structure models
- Basic clustering as a function of Ac




Storm Lake
Casino Beach
Lakeside
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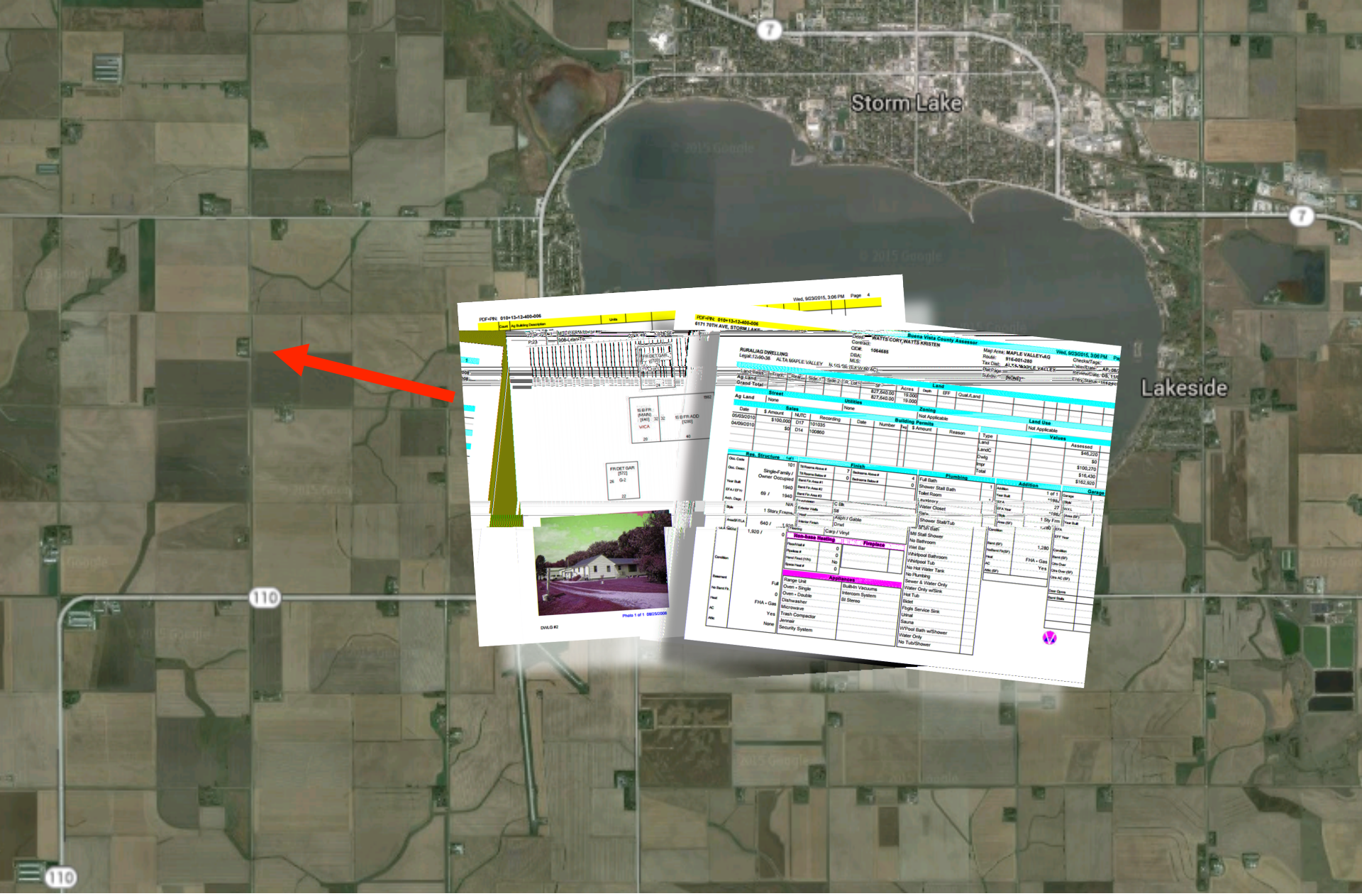
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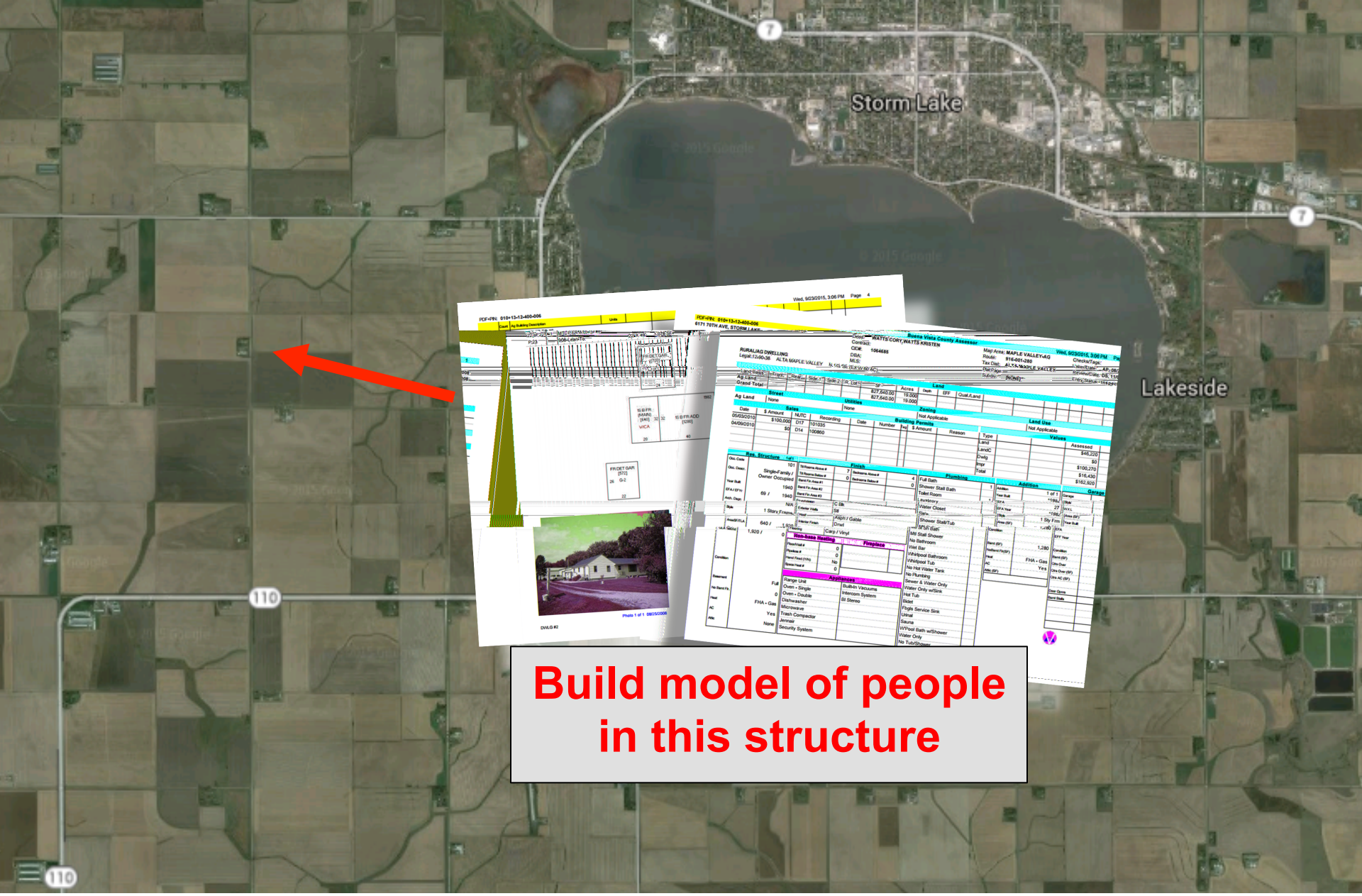

Build model of people in this structure


Storm Lake
Casino Beach
Lakeside
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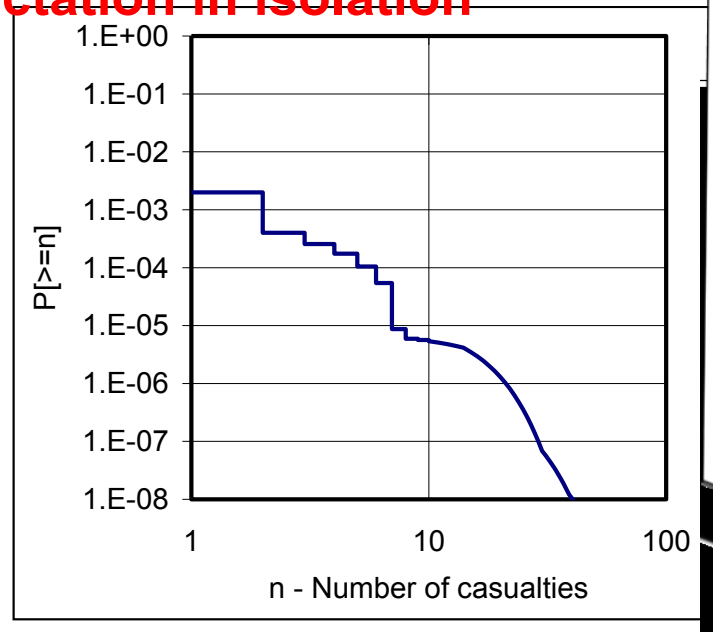
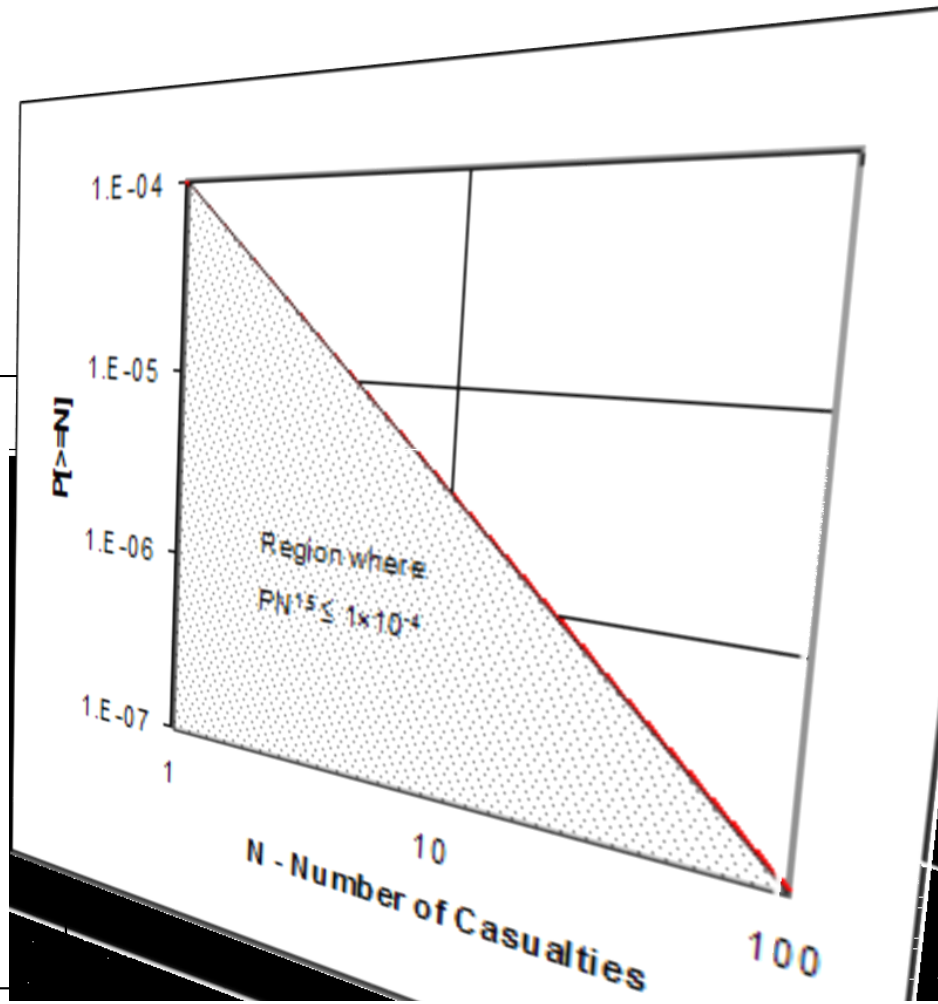
If Ac = x, how many individuals would be impacted

Results: Risk Modelling

- Apply risk profile
- Build boundaries based on acceptable catastrophe level
  - **Should open up more reasonable opportunities than applying casualty/fatality expectation in isolation**





Conclusions and Future Work

- Team
  - Young, growing team
  - Mathematics, modelling focus
  - At least 3 years with current core
- Focus
  - Population modelling in rural areas
  - Catastrophic verses Expected
  - Demonstrate the opportunity
- Next Steps
  - Integrate with Stanford tools
  - **Develop industry accessible database for population models**