



# PDC19 Impact Exercise: Probabilistic Asteroid Impact Risk Assessment

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Asteroid Threat Assessment Project

**IAA Planetary Defense Conference**

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College Park, MD

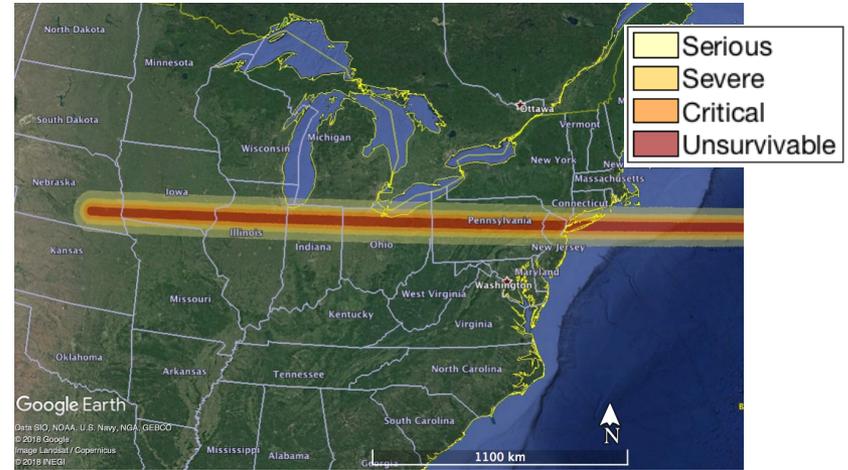


# Impact Risk Summary

## Characterization Summary & Updates

- Assessment date: 3 September 2024
- Impact date: 29 April 2027 (~2.7 years)
- Earth impact probability: 100%,
- Disrupted fragment expected to strike between East Nebraska to mid-Atlantic
- Diameter (m):  $65 \pm 15$  (1- $\sigma$ ), full range 12–117
- Energy: mean 15 Mt, range 57 kt – 80 Mt,
- Type: Disrupted fragment from S-class contact binary

## Potential Damage Zone Map

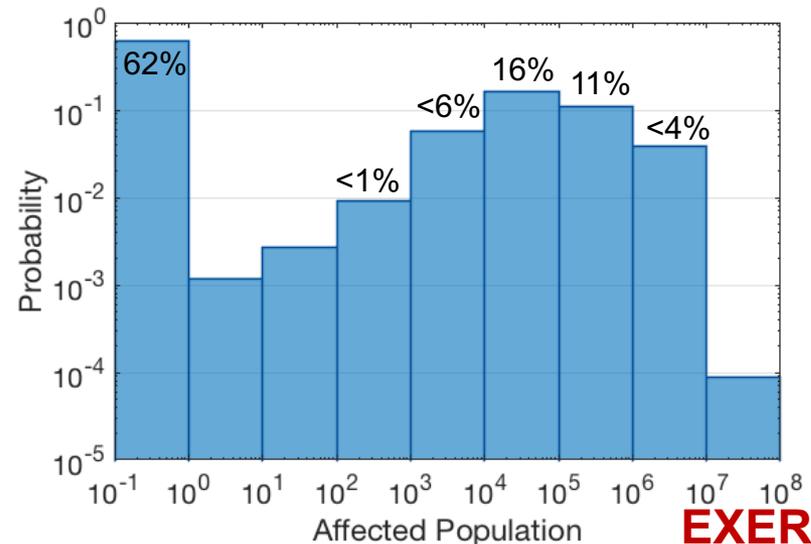


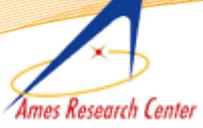
## Risk Summary

- Affected population: mean 146k, range 0–11.5M
- Likely airburst at ~16 km altitude (6.5–36 km).
- Blast overpressure is primary hazard.
- Damage out to ~84 km if larger, lower burst
- Little-to-no damage if burst is small & high

Damage Levels	Mean Radius	Radius Range
Serious	38 km	0 – 84 km
Severe	16 km	0 – 53 km
Critical	5.4 km	0 – 33 km
Unsurvivable	0.6 km	0 – 17 km

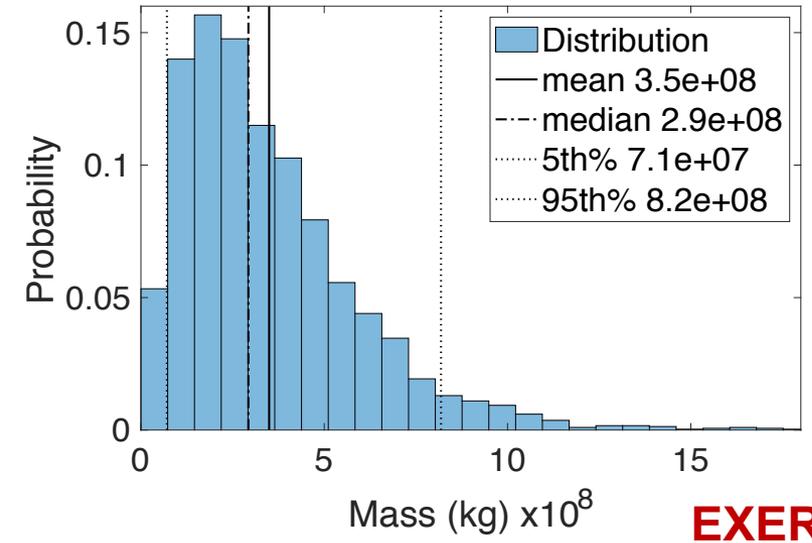
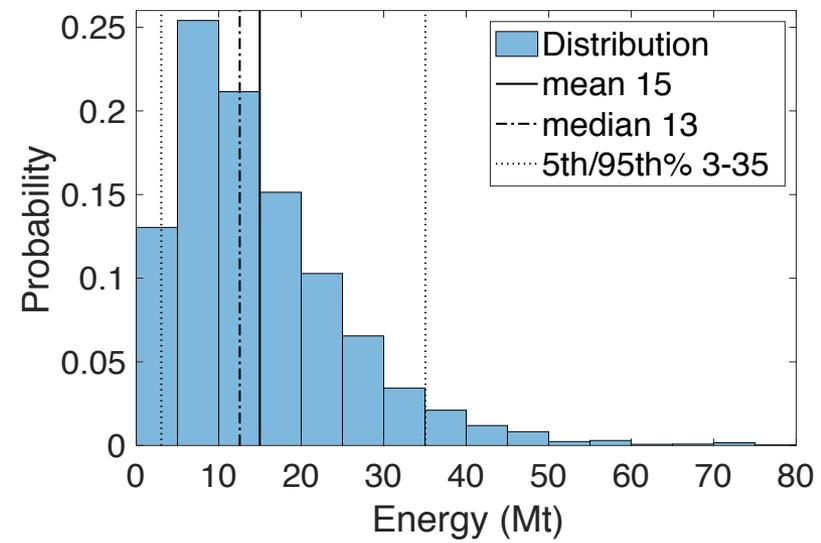
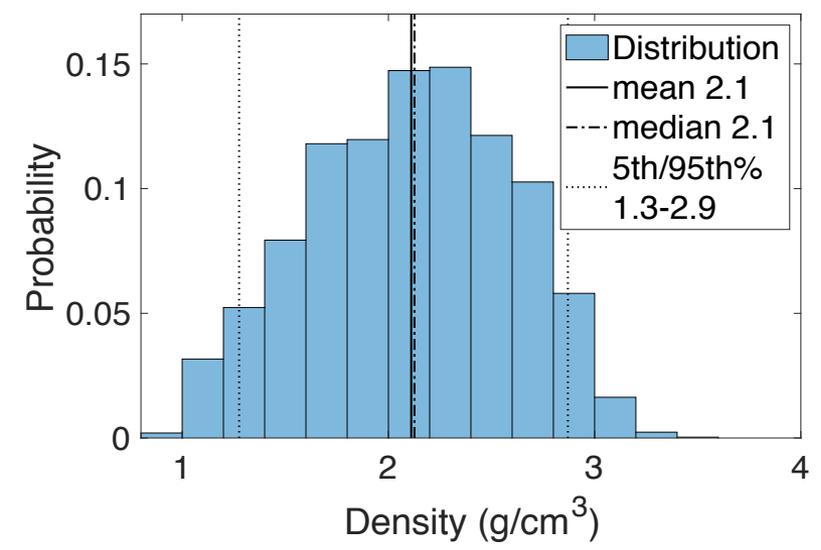
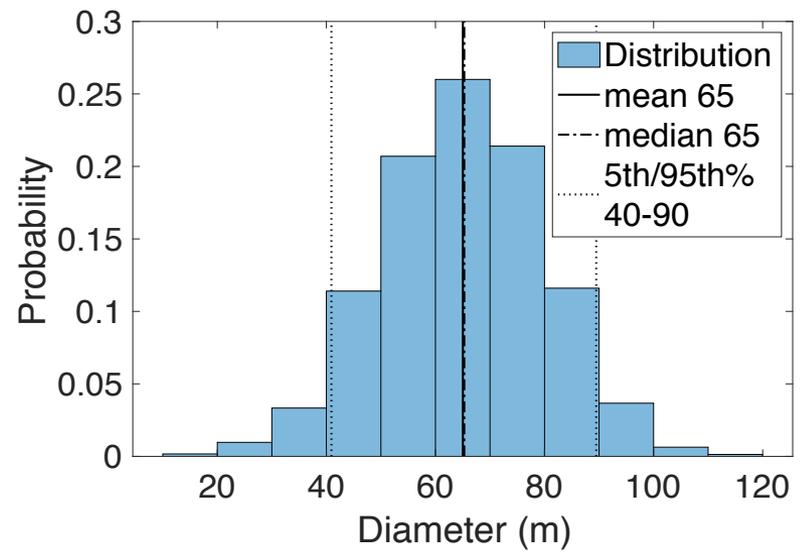
## Affected Population Probabilities



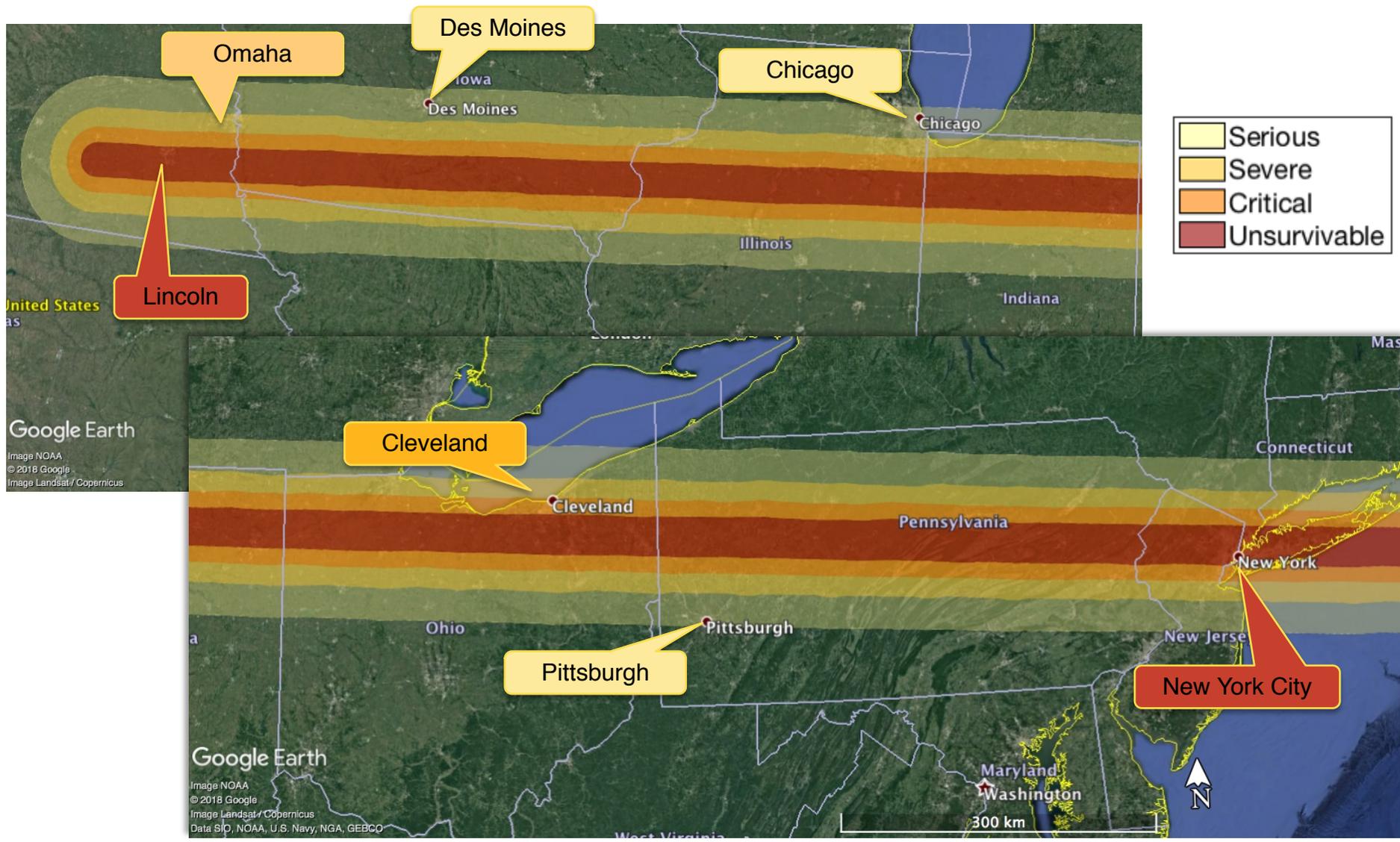


# Asteroid Properties

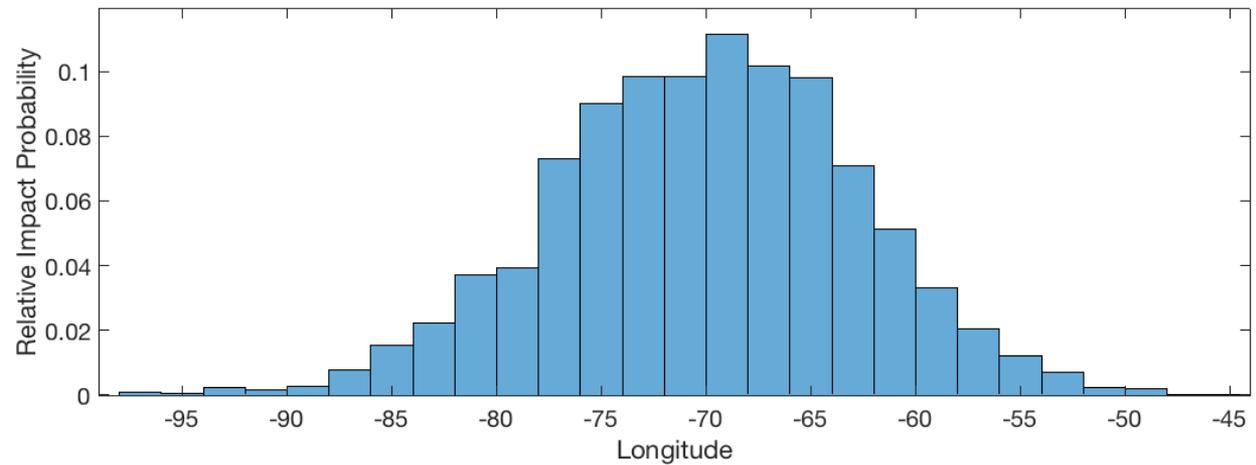
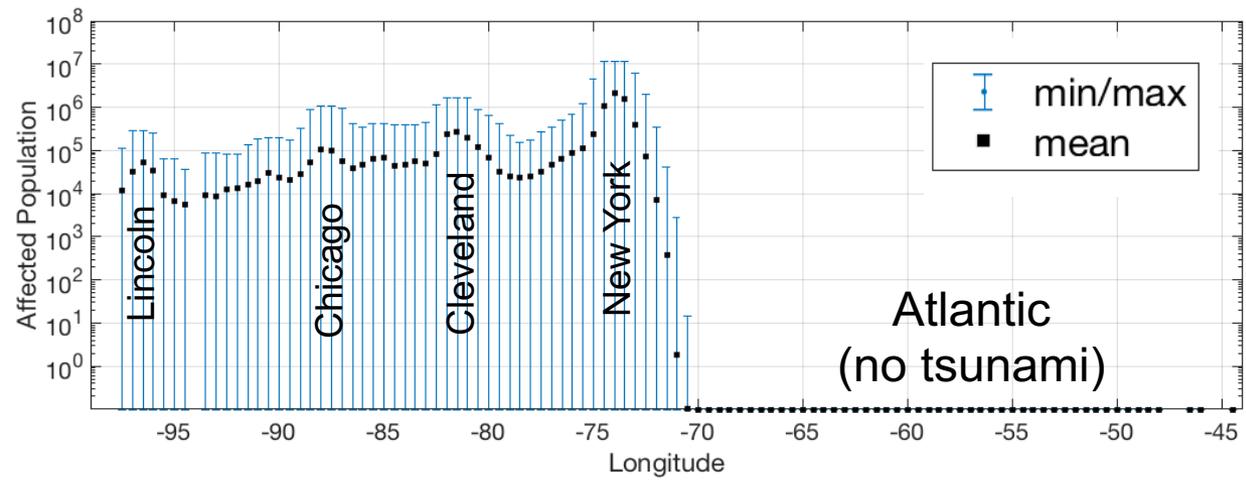
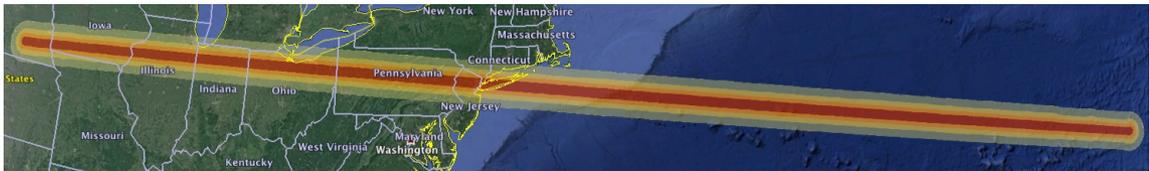
- J. Dotson, Bayesian Inference of Physical Properties for Impact Scenarios (IAA-PDC-19-02-P12)

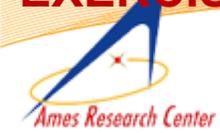


# Risk Swath



# Affected Population Ranges and Impact Risk Along Swath

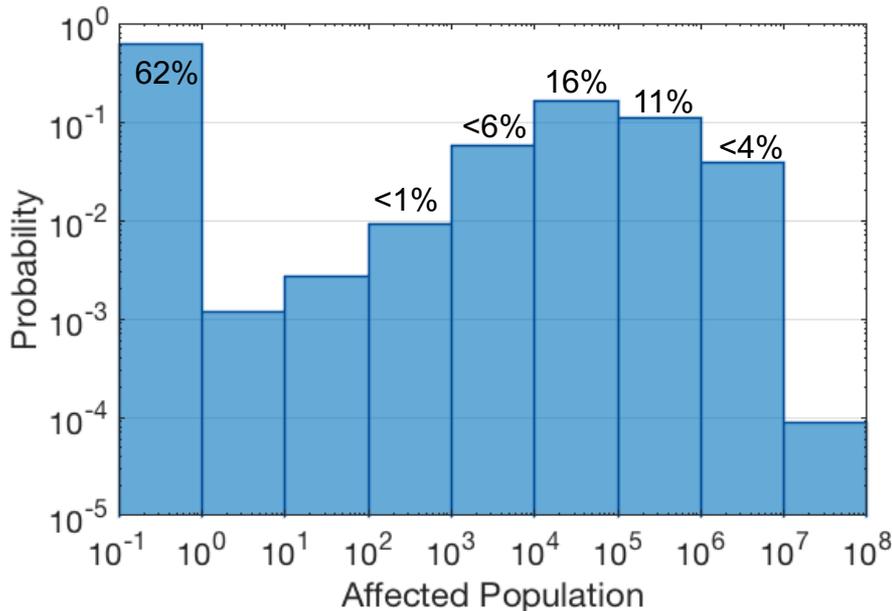




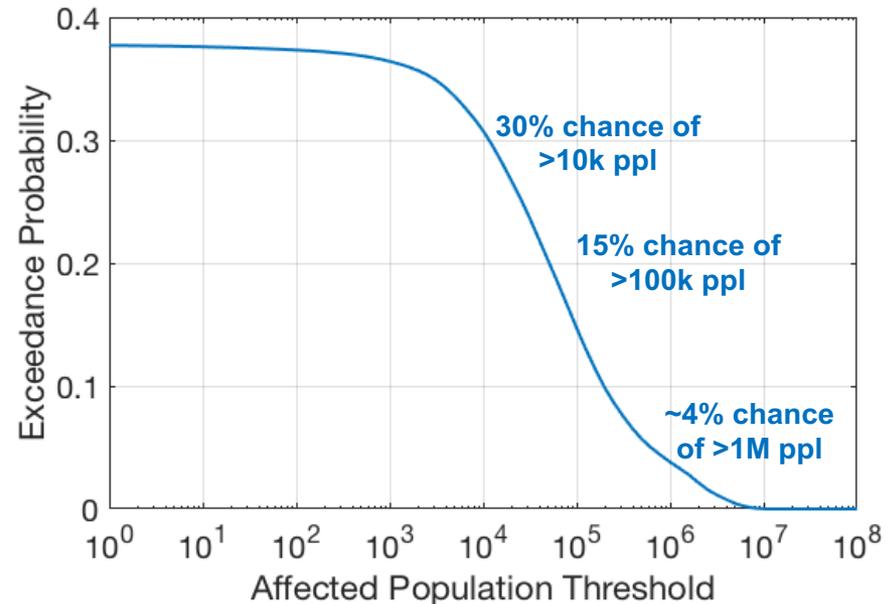
# Affected Population Probabilities



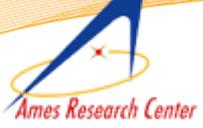
**Population risk histogram:**  
probabilities of different population ranges being affected



**Damage exceedance probabilities:**  
Likelihood of a certain number of people or more being affected



- No damage most likely, followed by 10-100k people
- Maximum affected population: 11.5 million people

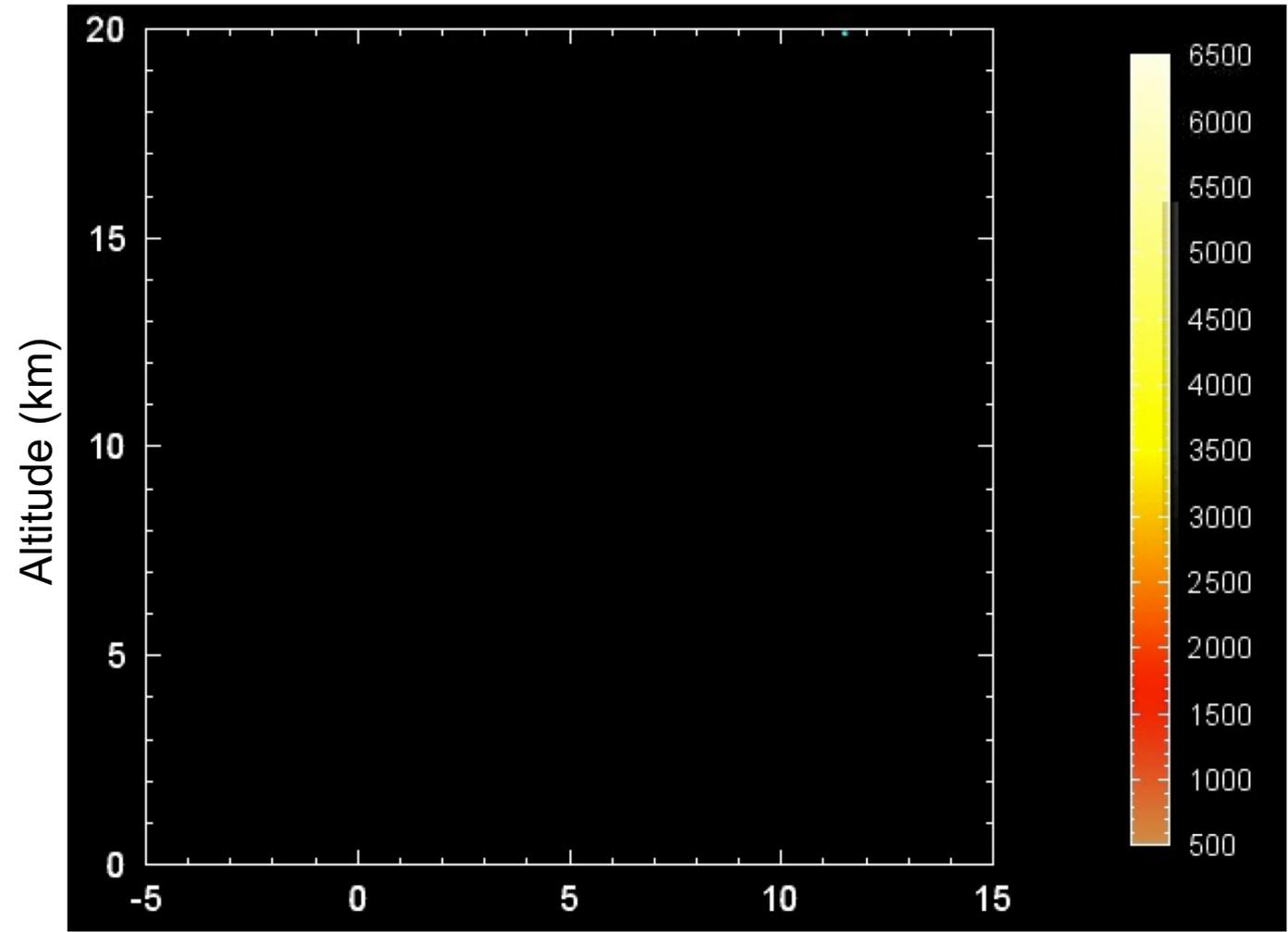


# CTH Blast Simulation

Mark Boslough (LANL)

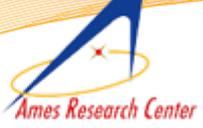


Temperature (K)



- Diameter: 70 m
- Energy: 23.5 Mt
- Entry: 19.1 km/s, 60°
- Composition:
  - Strong, dense S-type stone
  - 3 g/cm<sup>3</sup>
  - 10 MPa

Ground distance (km)

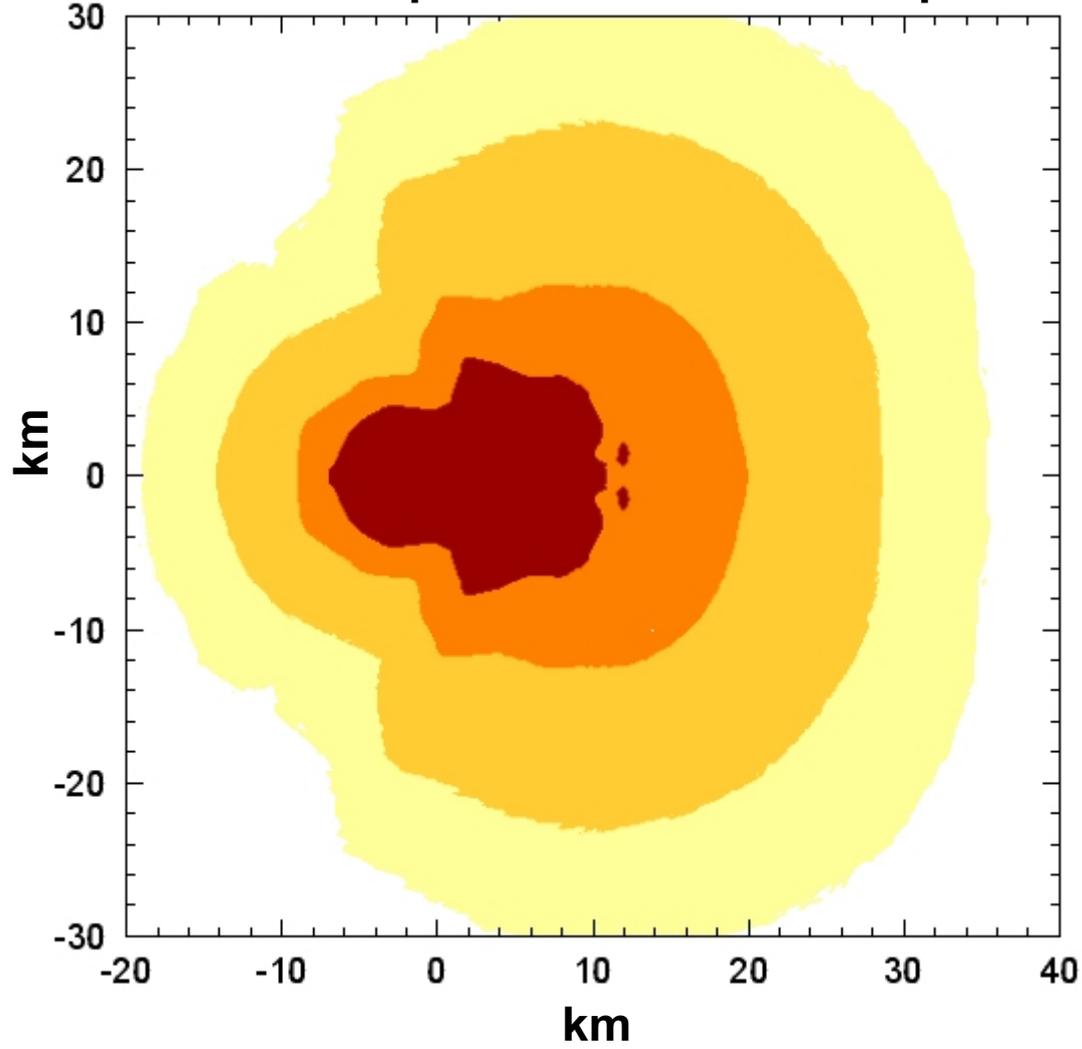


# CTH Blast Simulation

Mark Boslough (LANL)

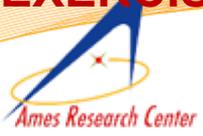


### Blast Overpressure Ground Footprint



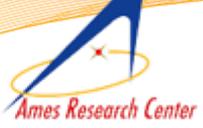
- Diameter: 70 m
- Energy: 23.5 Mt
- Entry: 19.1 km/s, 60°
- Composition:
  - strong, dense, S-type stone
  - Density: 3 g/cm<sup>3</sup>
  - Strength: 10 MPa

- ≥1 psi (serious)
- ≥2 psi (severe)
- ≥4 psi (critical)
- ≥10 psi (unsurvivable)



3 September 2024

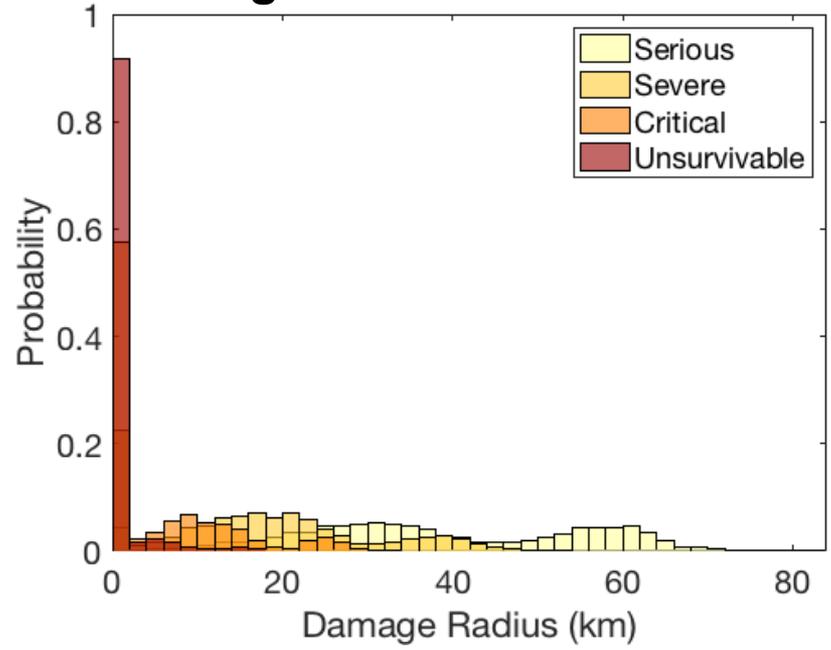
# BACKUP



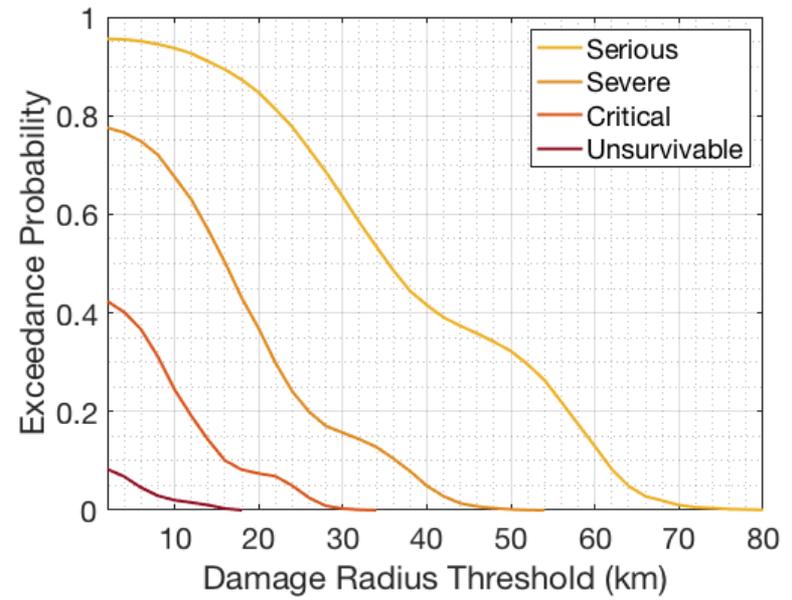
# Hazard & Damage Probabilities



**Damage Radius Probabilities**

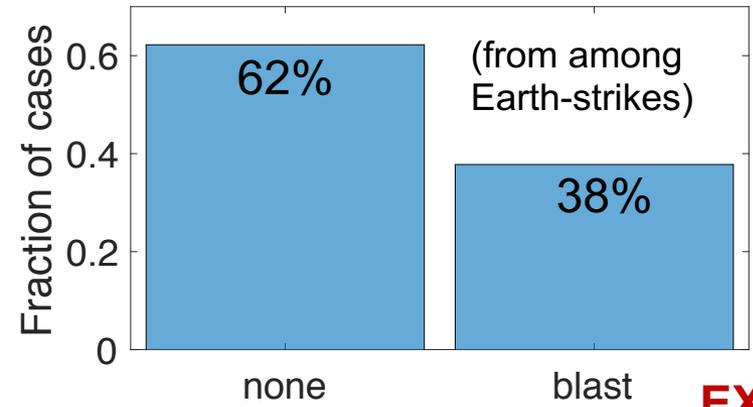


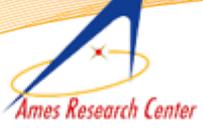
**Damage Radius Exceedance Probs**



Damage Levels	Mean Radius	Radius Range
Serious	38 km	0 – 84 km
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Critical	5.4 km	0 – 33 km
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**Driving Hazard Sources**





# Hazard & Damage Probabilities

