

# EMP Risk Assessment and Mitigation Prioritization

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# Electromagnetic Pulse (EMP)

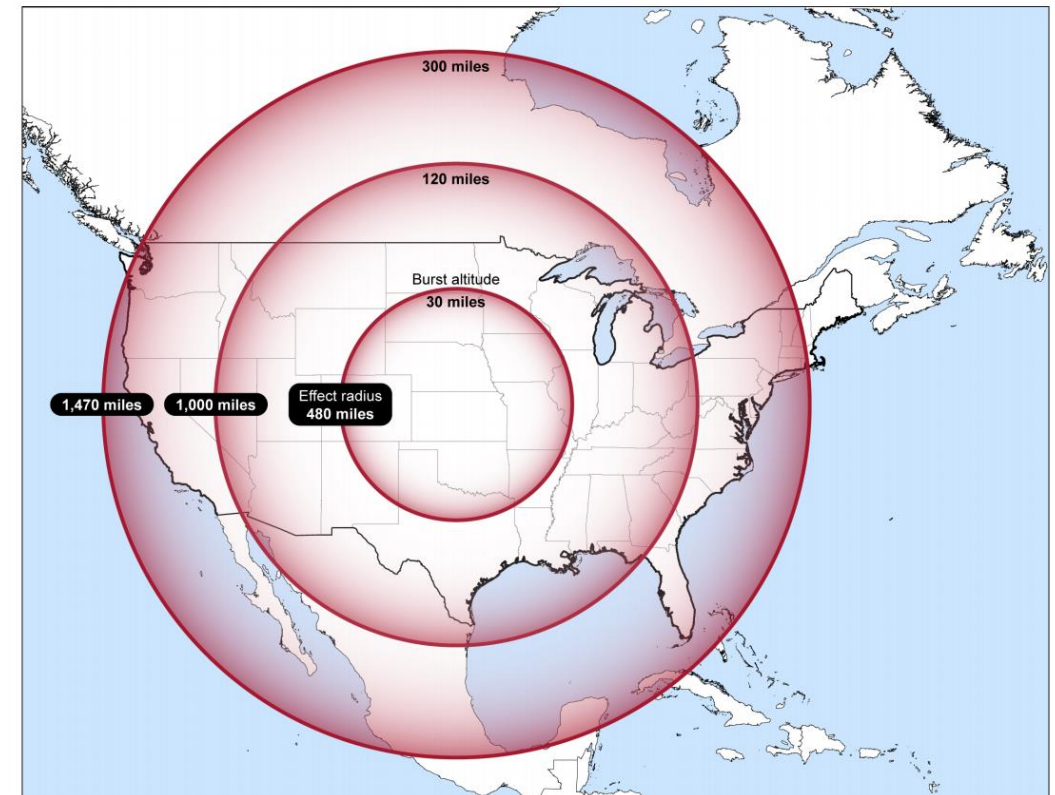
## “An Extreme Electromagnetic Incident”

- EMP occurs when a nuclear device is detonated 40+km above the earth’s surface
- “[EMP] can affect **large geographic areas**, disrupting elements critical to the Nation’s security and economic prosperity...”

Executive Order on Coordinating National Resilience to Electromagnetic Pulses

- Power grid
- Communications network
- Other critical infrastructure with electronics
- → State of anarchy

Figure 1: Example of Estimated Impact Area of High-Altitude Electromagnetic Pulse, by Height of Burst



Source: Gary Smith, “Electromagnetic Pulse Threats,” Testimony before the House Committee on National Security (July 16, 1997); MapInfo (map). | GAO-16-243

# EMP – A “Hard Problem”

Different from naturally occurring hazards

- “Low probability/high consequence scenario that challenge[s] effective policymaking...”
  - “Assessments of the risks ... are intrinsically difficult to produce due to the rarity – or complete absence – of actual events...”
  - Significant technical and operational uncertainties (threat & effect) lead to policy challenges
- Significantly different from other large-scale hazards – **effects occur within milliseconds or seconds**



STRATEGY  
FOR  
PROTECTING AND PREPARING THE HOMELAND  
AGAINST THREATS OF ELECTROMAGNETIC PULSE  
AND  
GEOMAGNETIC DISTURBANCES

October 9, 2018

*Vision: The United States is prepared for extreme electromagnetic incidents and capable of quickly restoring critical infrastructure and supporting communities to fully recover.*



# Hypothesis

- EMP is a **significant threat** that could lead to a **large-scale disaster**
- Such **disasters are preventable** with proper tools and designs



## EMP Resiliency Status

- Military systems are designed for, and tested against, EMP threats (surrogate tests)
- Civilian systems generally do not require EMP hardening
- Current M&S techniques have limited capabilities
  - Only support a limited set uncertainties
  - Effects are power-based and do not predict actual electronic system degradation

# Project Overview

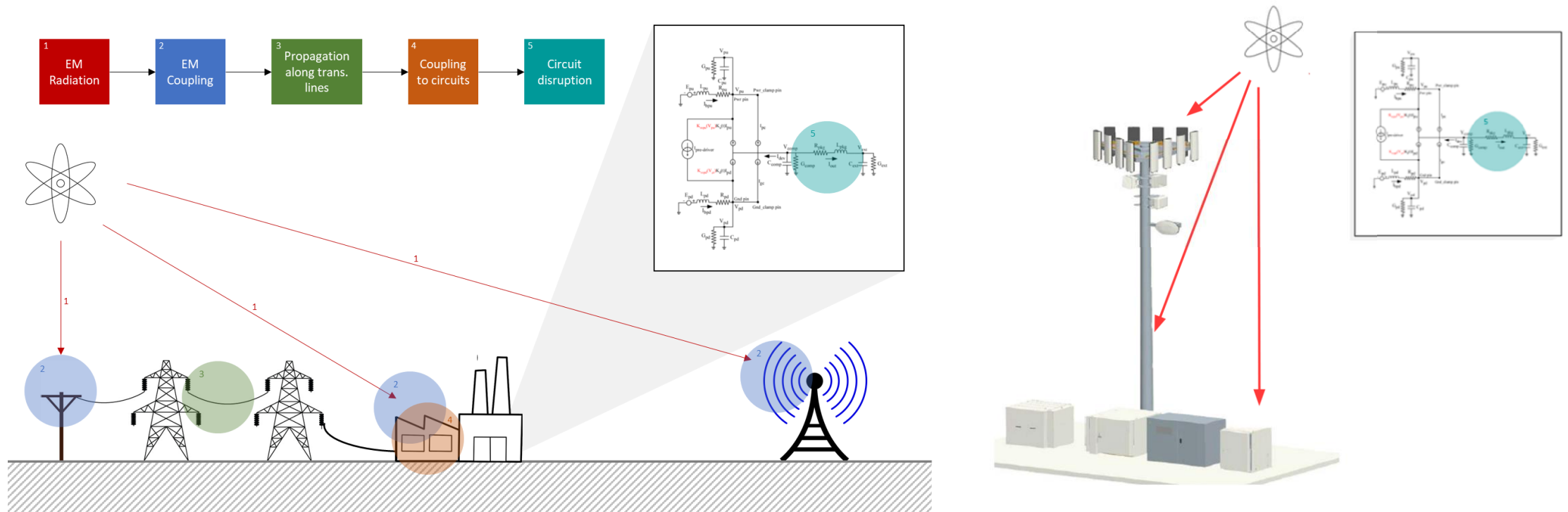
- Develop an **EMP risk assessment capability**
  - Accounts for system, operational, and component variabilities
  - Evaluates the effectiveness of mitigation approaches
- Conduct assessments on critical infrastructures – **communication systems**



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# Impact is Assessed at the Circuit Level

## Focus on System Performance Metrics



# Transition Plans

- Under an STTR, Synclesis is commercializing EMI modeling approaches developed at UIUC
- This project extends our modeling framework capabilities to EMP applications
- Commercialization of this capability will occur in conjunction with the STTR commercialization effort
  - I-Corps project participation
  - LIM simulator
  - MEAD framework

# Transition Plans (cont'd)

- End Users (letters of support)
  - Electronic Design Industry (signal integrity)
  - Computer Aided Design
  - Aerospace/DoD