LLNL Wildfire and Infrastructure Resilience R&D

PICG Wildfire Mitigation Workstream Meeting

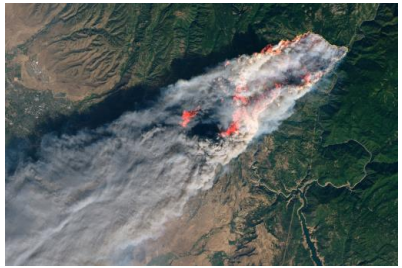
A.J. Simon Associate Program Leader for Climate Resilient Infrastructure
with Jeff Mirocha (wildfire) and Vaibhav Donde (infrastructure)

December 2, 2020

LLNL-PRES-817239

Lawrence Livermore National Laboratory

Internal Investments: Science and Collaborations funded by LLNL and University of California (UC)



Livermore: Understanding Urban and Wildland Fire Dynamics

LLNL Staff:

- Jeff Mirocha (Project Lead), 4 postdocs, 3 staff scientists

Strategic Partners:

- National Center for Atmospheric Research
- San Jose State University

UC 1: Assessment and mitigation of wildfire-induced air pollution

LLNL Staff: Jeff Mirocha

Strategic Partners: 5 UC campuses and Los Alamos

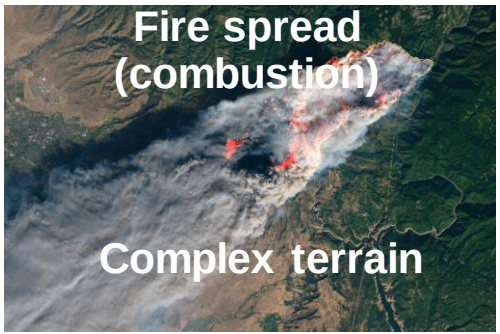
UC 2: Climate risk and mitigation

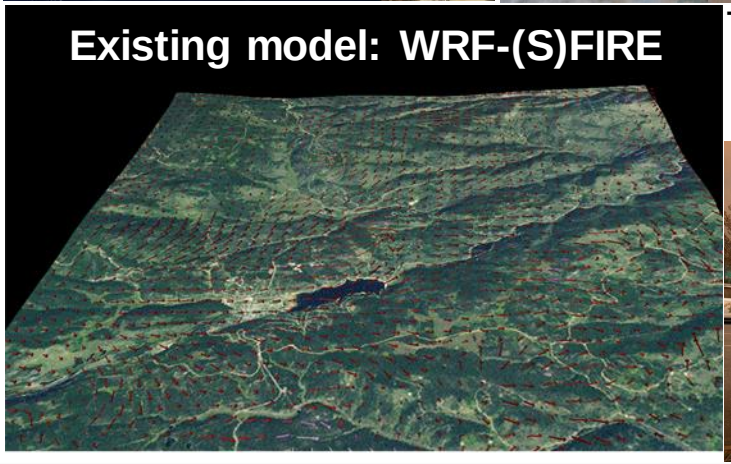
LLNL Staff: Don Lucas

Strategic Partners: 3 UC campuses, Los Alamos, Berkeley Lab

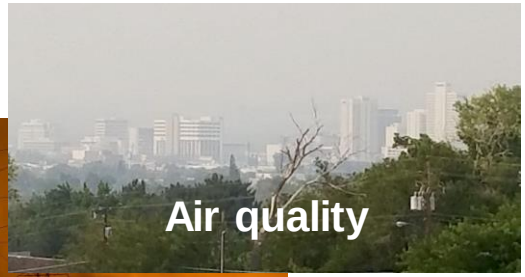
LDRD: Laboratory Directed Research & Development
UCOP: University of California Office of the President

LLNL is developing next-generation wildfire/emissions simulations





The National Atmospheric Release Advisory Center (NARAC) provides foundational capabilities



These tools can be applied to fire mitigation and risk management strategies

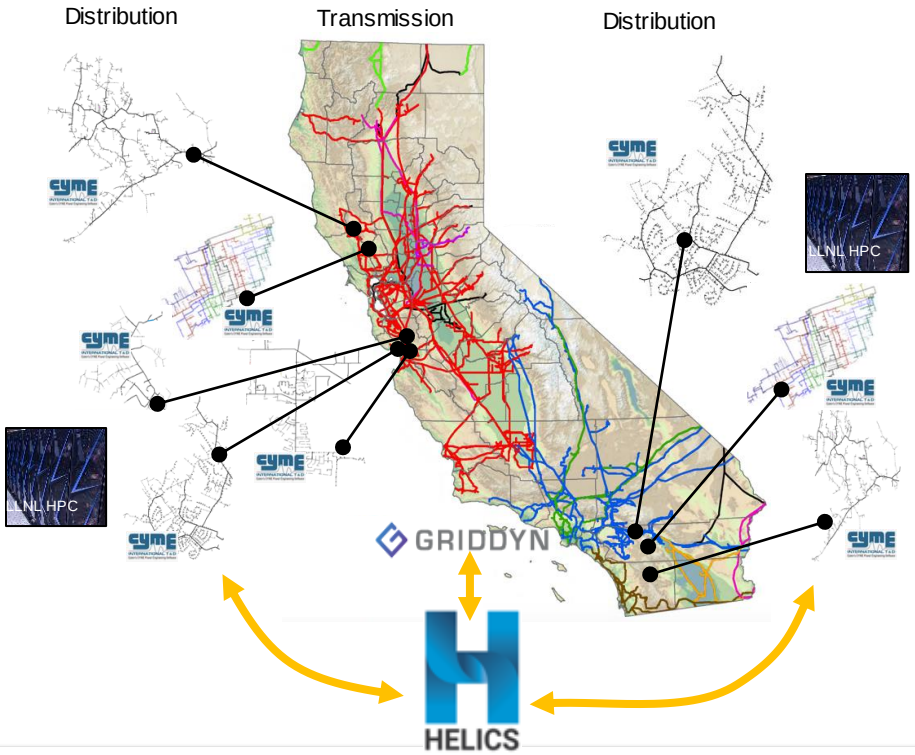
Civilian safety, assets

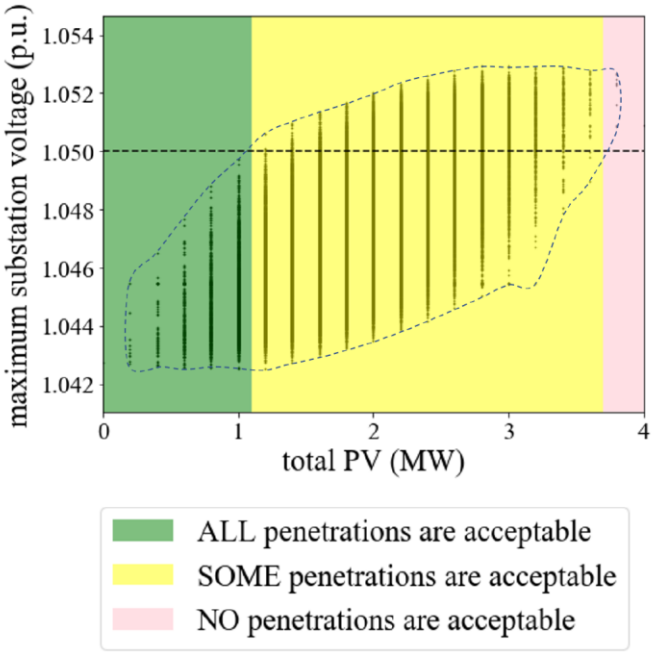
- Forest Thinning
- Prescribed burns
- Firebreaks
- Defensible space
- Structure hardening
- Evacuation routes
- Attribution: management practices vs. climate/weather
- Optimal response deployment

Nuclear and National Security Infrastructure

Societal Infrastructure

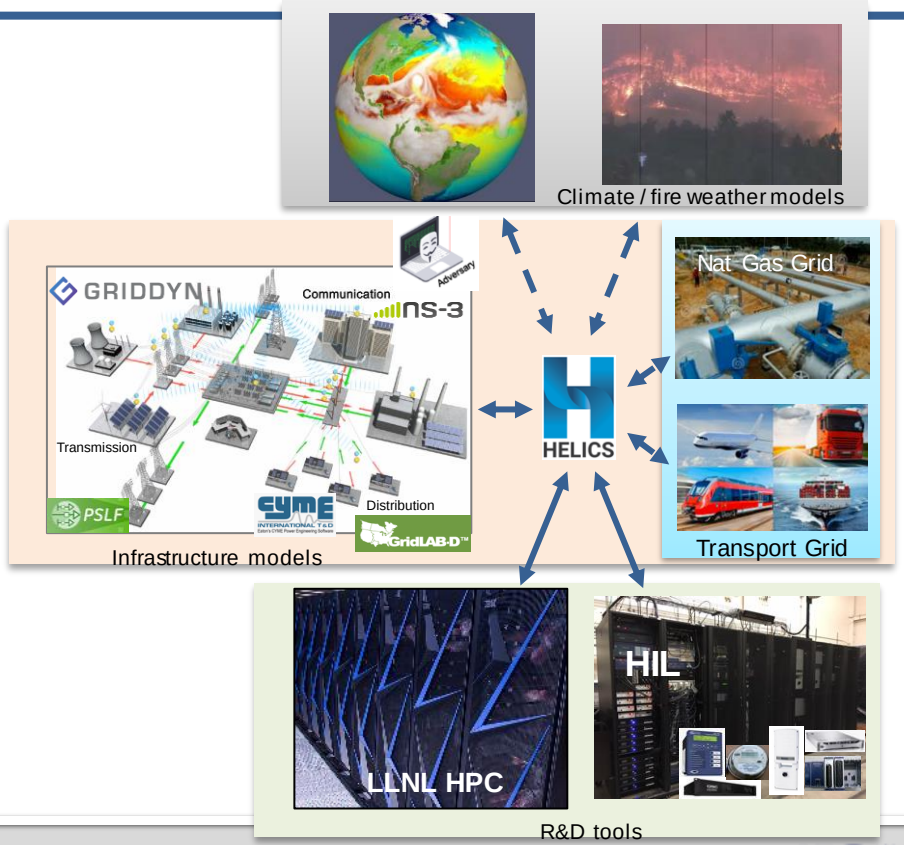
HELICS co-simulation platform provides a mechanism to capture infrastructure interdependencies





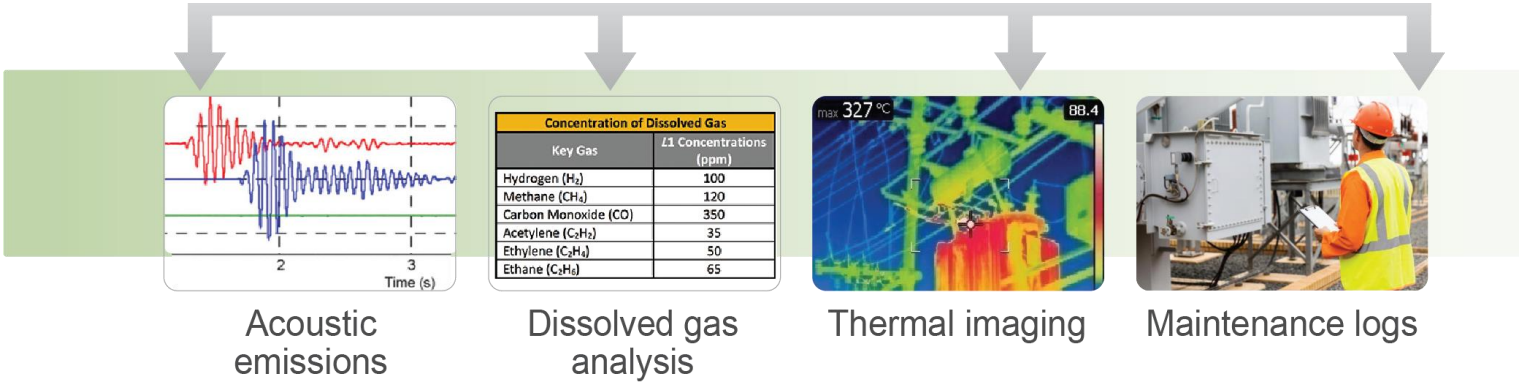
Coupling the climate/weather models with infrastructure models will provide a unified platform for resiliency analysis

- Study coupled infrastructure systems WITH weather/fire interactions:
  - Transmission & distribution
  - natural gas
  - cyber/communications
  - transportation
- LLNL leverages High Performance Computing and Hardware-in-the-Loop testing to enable “scaled up”, efficient, and realistic analysis.



Advanced sensing and computing for fault detection and resilient operation

- **Incipient failure analysis** uses machine learning and multi-modal data fusion to identify grid components at highest risk for arcing failure.



- **Grid Resonance Probe** detects and identifies faults in de-energized grids using active, low-energy probing and advanced signal processing.

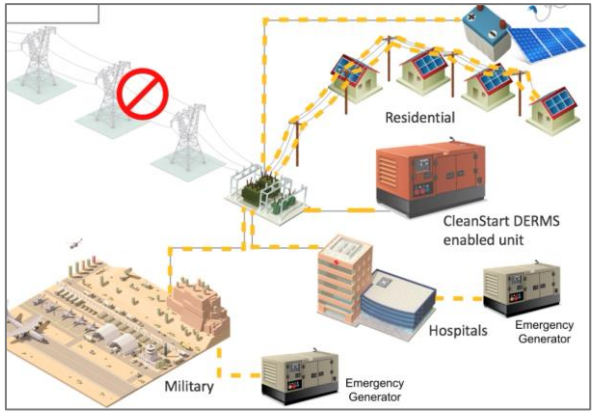
Advanced sensing and computing for fault detection and resilient operation

- **gollnlp** LLNL-developed software calculates the optimal sequence for black-start recovery.
  - Recent winner at ARPA-E Grid Optimization Competition, ranked 1st in almost every category.
- **CleanStart DERMS** Integrated strategies to leverage *clean distributed energy resources* to form a microgrid.
  - Demonstrates a "Leaves to the Root" approach.

gollnlp

Security-constrained optimal power flow

- 70,000 buses
- 20,000 contingencies
- under 10 minutes




Lawrence Livermore
National Laboratory