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Larry X Schneider
Senior Manager

Pulsed Power Sciences Center, Science & Technology Division

Sandia National Laboratories
Albuquerque, NM 87185-1181
lxschne@sandia.gov

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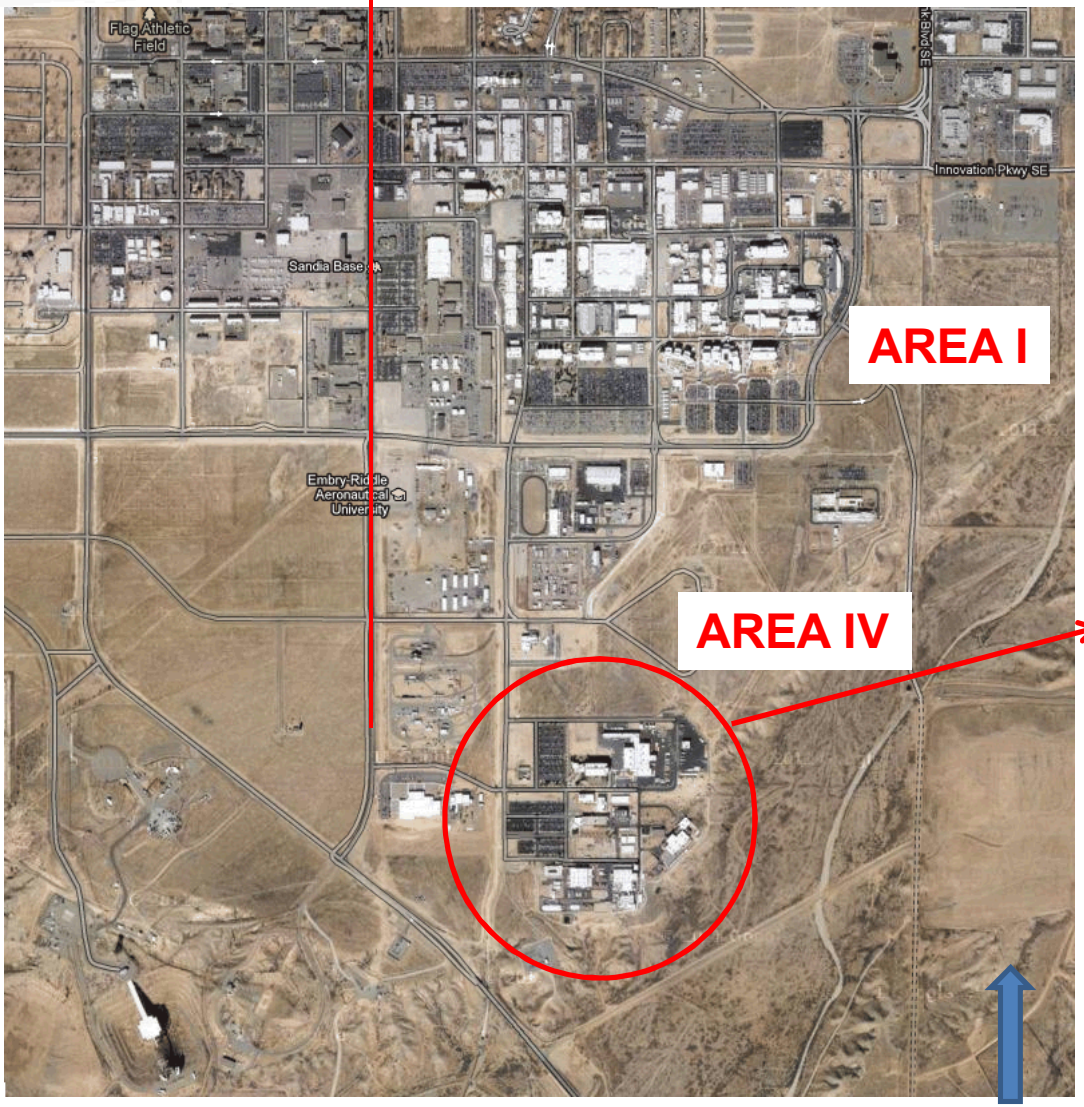
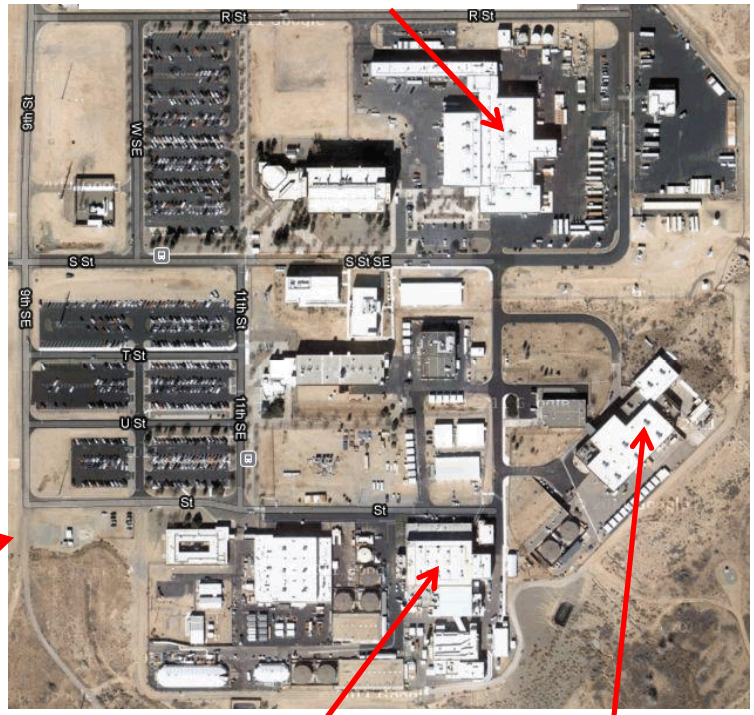
Pulsed Power and Radiation Sciences
Sandia Laboratories Area IV

Wyoming



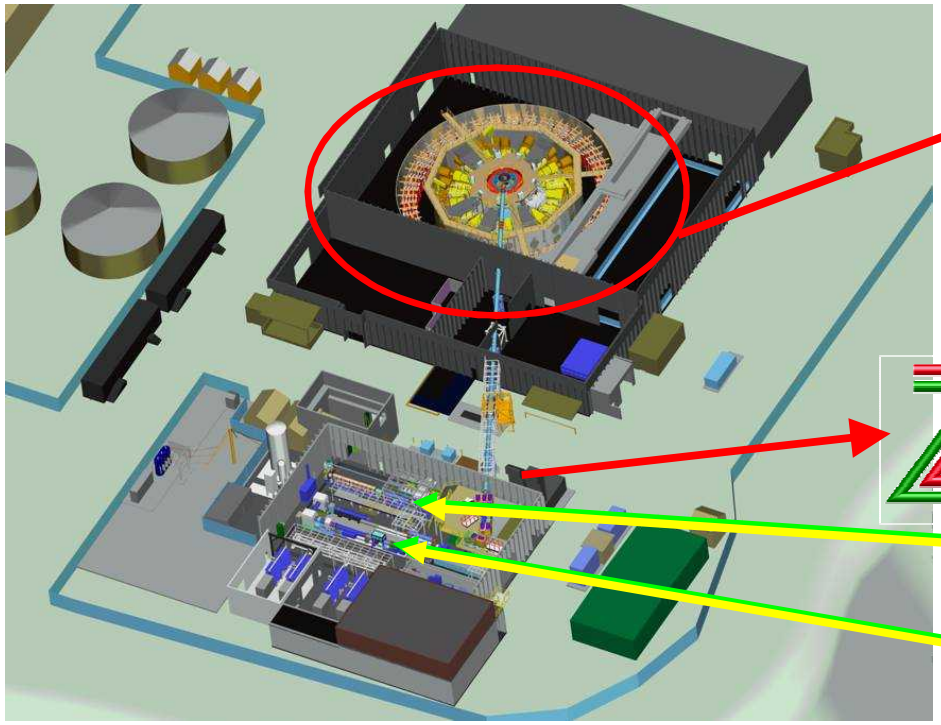
HAWK
World's largest DC-like electron beam accelerator



Z Machine (350 TW, 26 MA)
World's most powerful radiation source for fusion, dynamic materials and radiation effects sciences

Hermes III
Flash x-ray source for nuclear weapons effects testing

The Z Facility is a world record holder in high energy density physics and dynamic materials science – and a centerfold



Z

Z Backlighter

Z Petawatt

Z Beamlet

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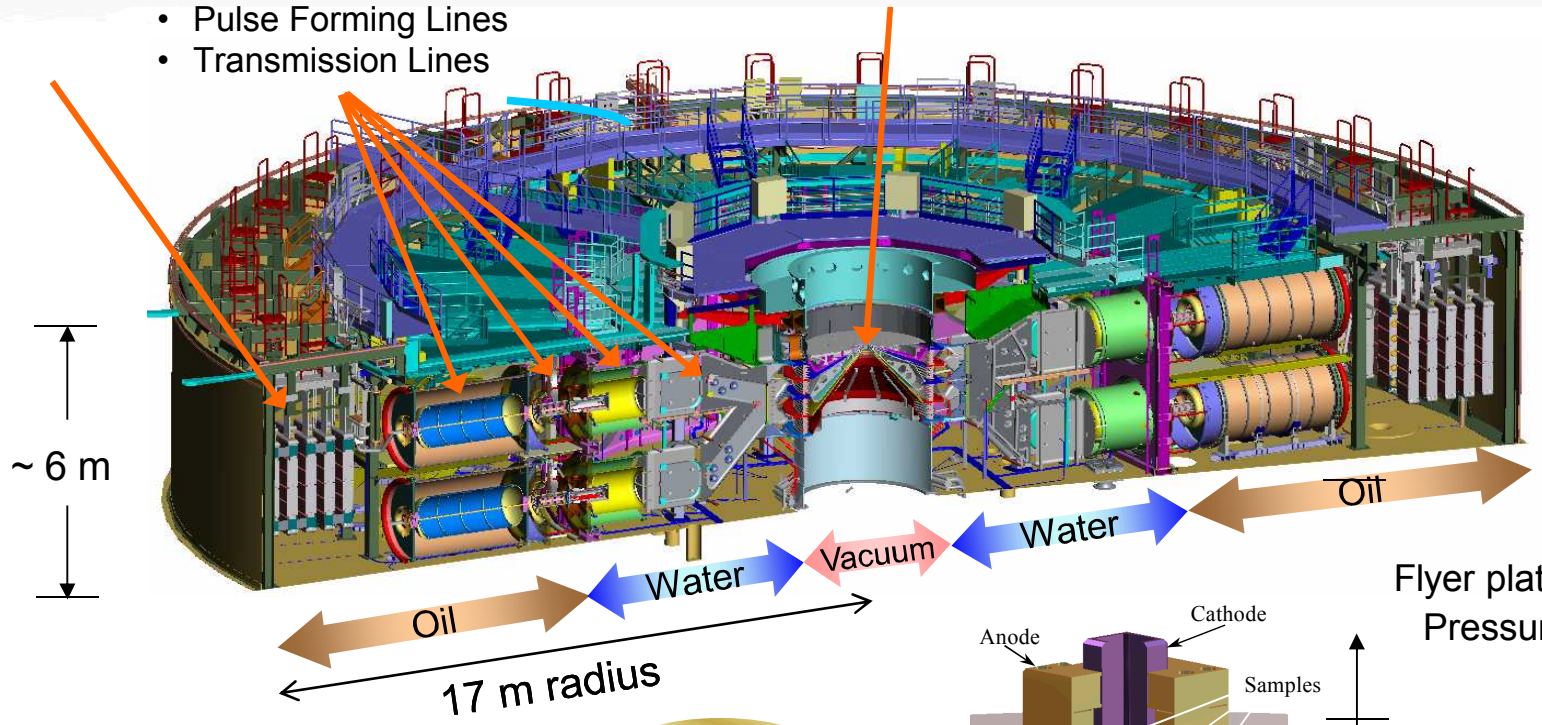
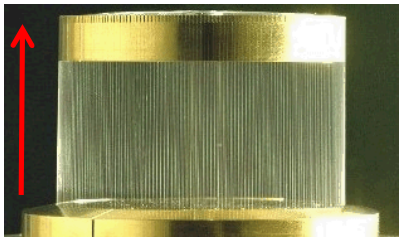
Z Represents the core of pulsed power sciences

Pulse Forming Section:

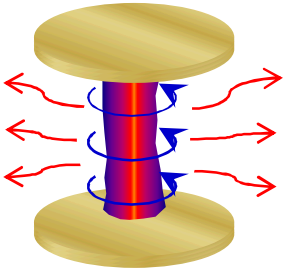
- Intermediate Storage Capacitors
- Laser triggered gas switches
- Pulse Forming Lines
- Transmission Lines

Experiment Load Region

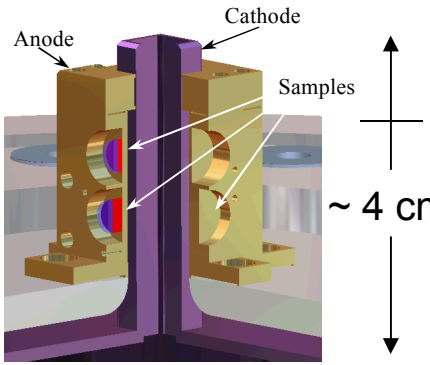




Wire-array z-pinch load for radiation effects and inertial confinement fusion

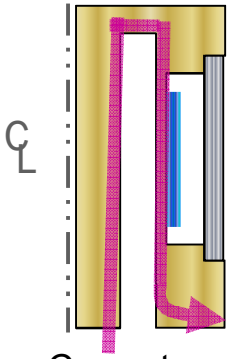


Implosion/stagnation 300 TW, 2 MJ x-ray



Magnetic compression load for dynamic materials experiments

Flyer plate > 40 km/sec
Pressure > 10 Mbar



22 MJ stored energy, 26 MA peak current, 100-600ns rise times

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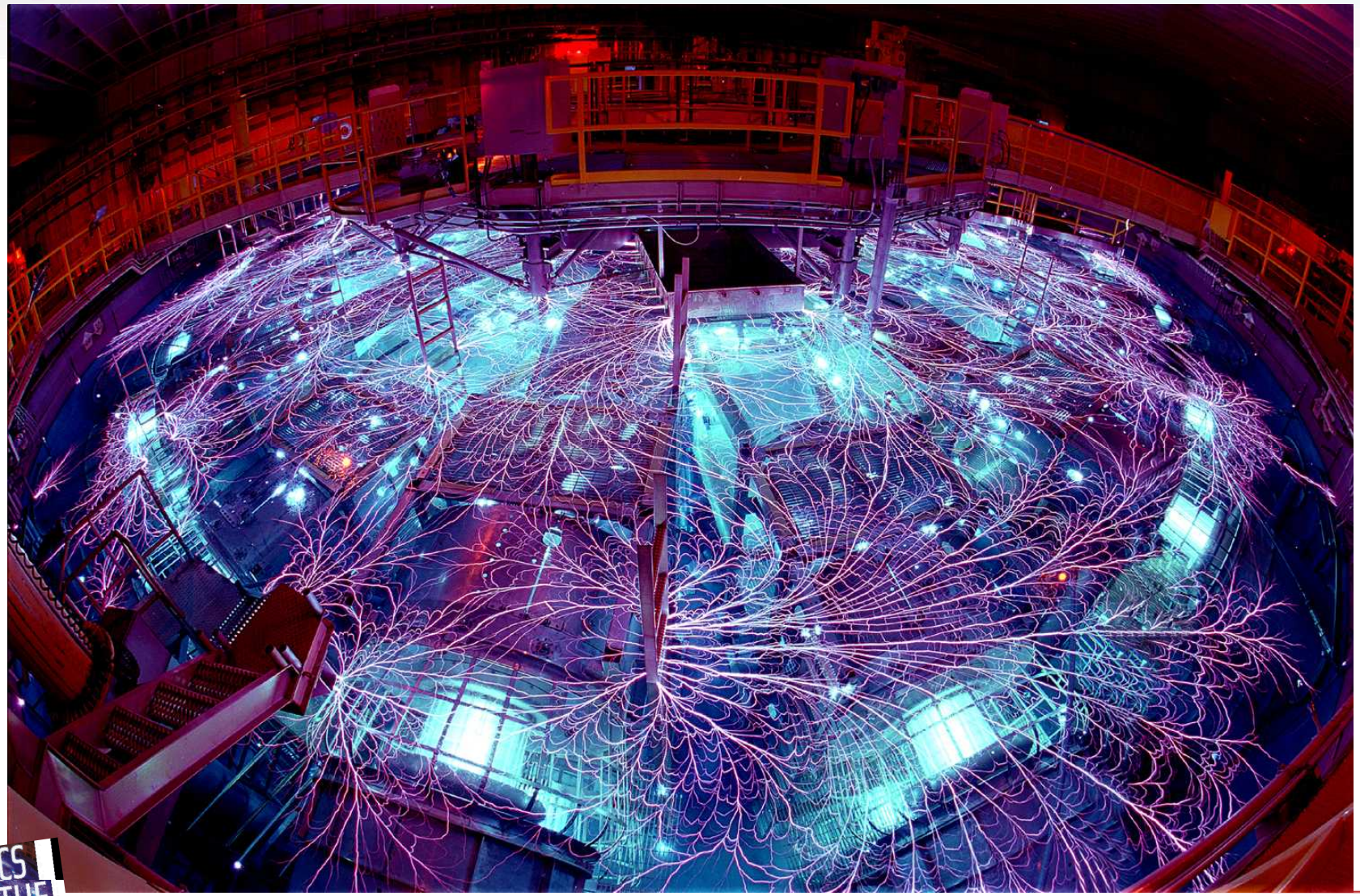
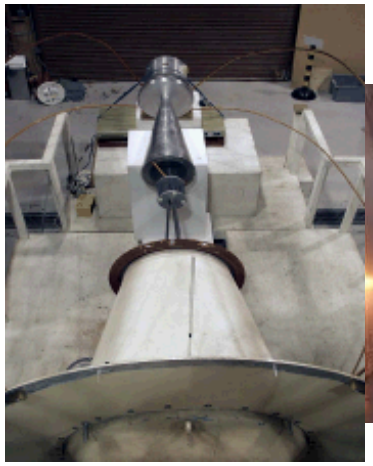
Arcing on the surface of the water and gas switch closure can be seen during operation of an older version of Z. These features disappear within a microsecond.



Nuclear weapons require EM qualification to demanding Stockpile-to-target-sequence (STS) requirements

Lifecycle Engineering



- Weapon Storage
- Transportation
- Maintenance/Surveillance
- Storage on delivery platform
- Launch and in-flight path
- Normal Environments
  - EMR, ESD, Nearby lightning, degaussing
- Abnormal Environments
  - Lightning
  - Power lines
- Hostile Environments
  - Nuclear effects (DEMP, SREMP, SGEMP)
  - EM weapons, HPM

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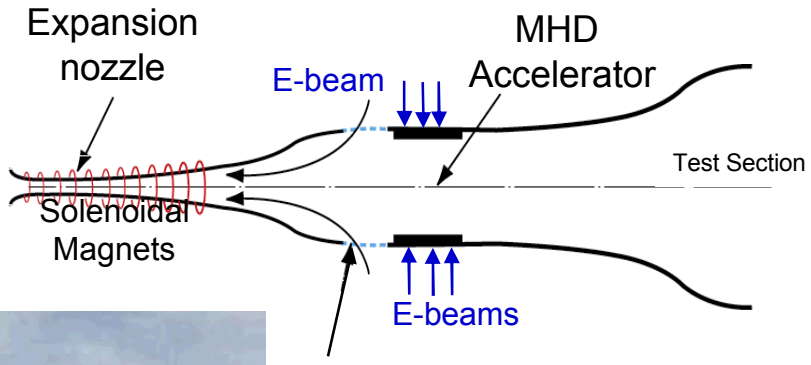
Long runtime hypersonic ground test capabilities for Scramjet engine development

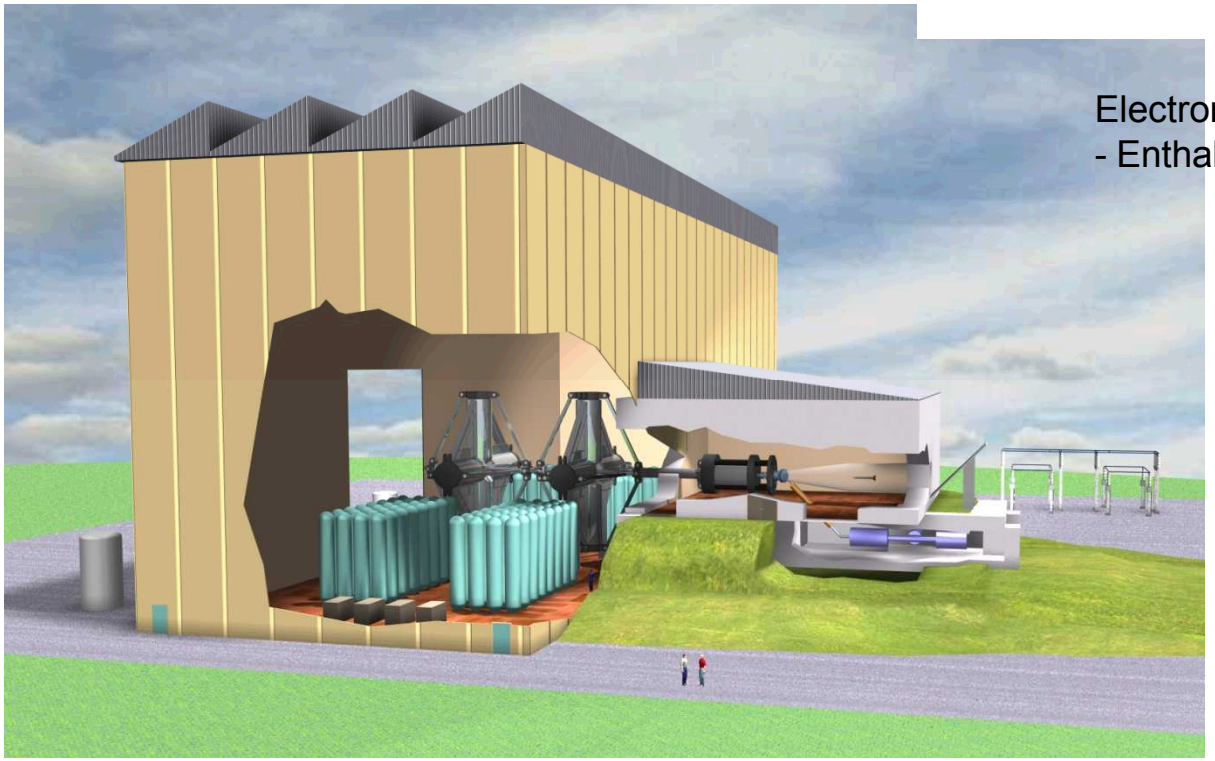
Electron beam technology enables radiative energy addition & MHD acceleration

> Mach 8
1 second operation
Pure air

High pressure air supply



Electron Beam "Heater"
- Enthalpy addition



Radiative Energy Addition:
Uses electron beam source to add energy to the flow which reduces the requirements on the high pressure air source.

MHD Accelerator:
Uses electron beams for electrical conductivity. No alkali seeding is used resulting in relatively clean air compared to previous MHD approaches.

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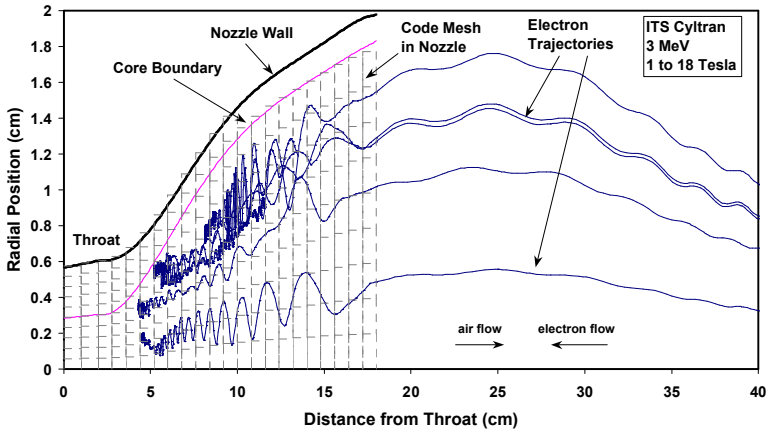
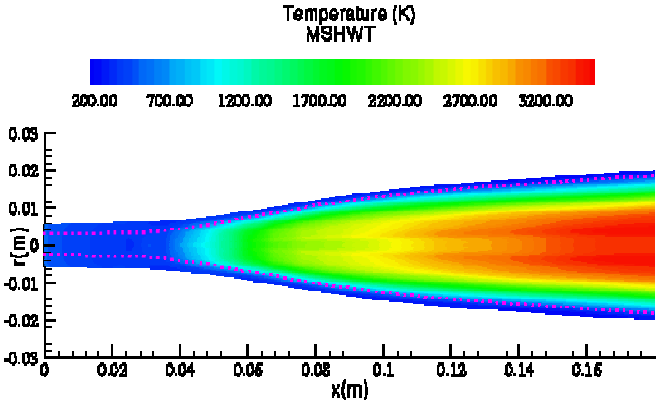
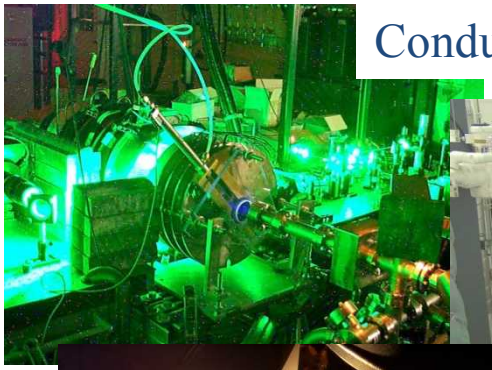
Modeling, analysis, validation experiments, Complex system design & integration

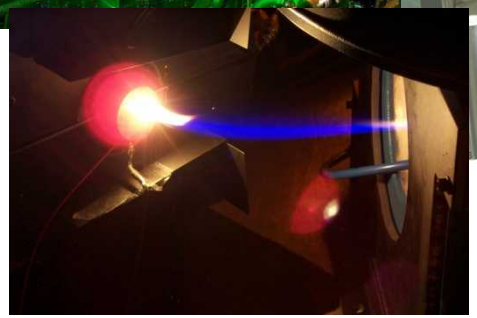
Coupled electron/photon Monte Carlo transport codes for energy addition and CFD





Conduct of complex experiments





World class accelerator technology development

World's first large aperture vacuum window

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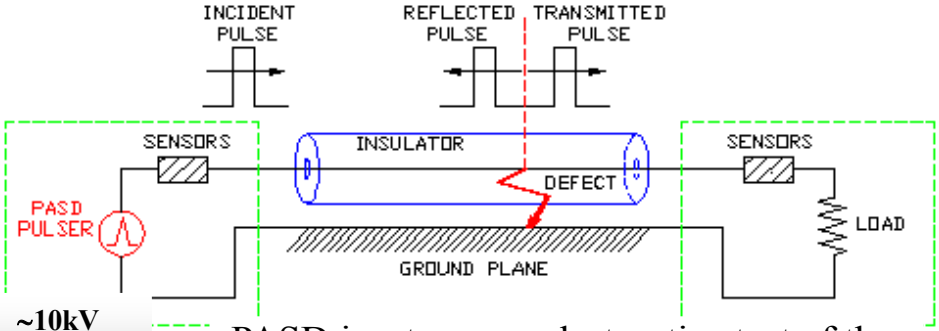
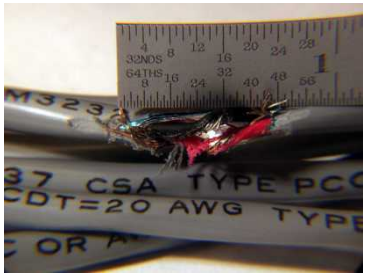
Expertise in short-pulse breakdown led to Pulse Arrested Spark Discharge (PASD)

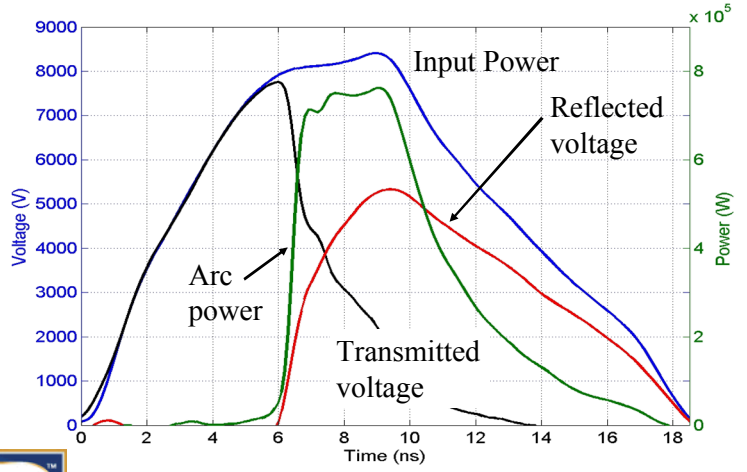
Work for Others Programs

PASD can find and locate what no others can see – from pin-holes in the dielectric to crushed, but fully functional cables, waiting for a disaster



PASD is a true non-destructive test of the dielectric strength of insulation





ASTRONICS CORPORATION

R&D 100

-Winner R&D 100 Award from R&D magazine

-Winner Federal Laboratories Consortium Award for Interagency Partnering

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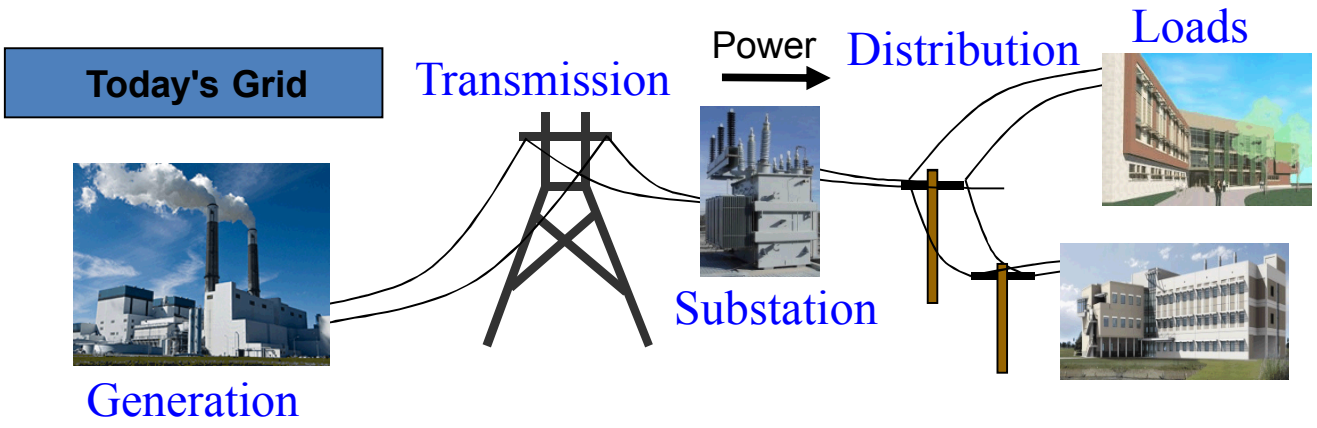
The Electrical Power Grid is based on a foundation created over 100 years ago



- Centralized generation
- Excess storage
- Excess generation
- Dispatchable energy
- Demand forecasting
- Human feedback
- Small perturbations
- Essentially open loop

This topology limits the use of renewable energy sources and is vulnerable to terrorist attacks, natural disasters, infrastructure failures

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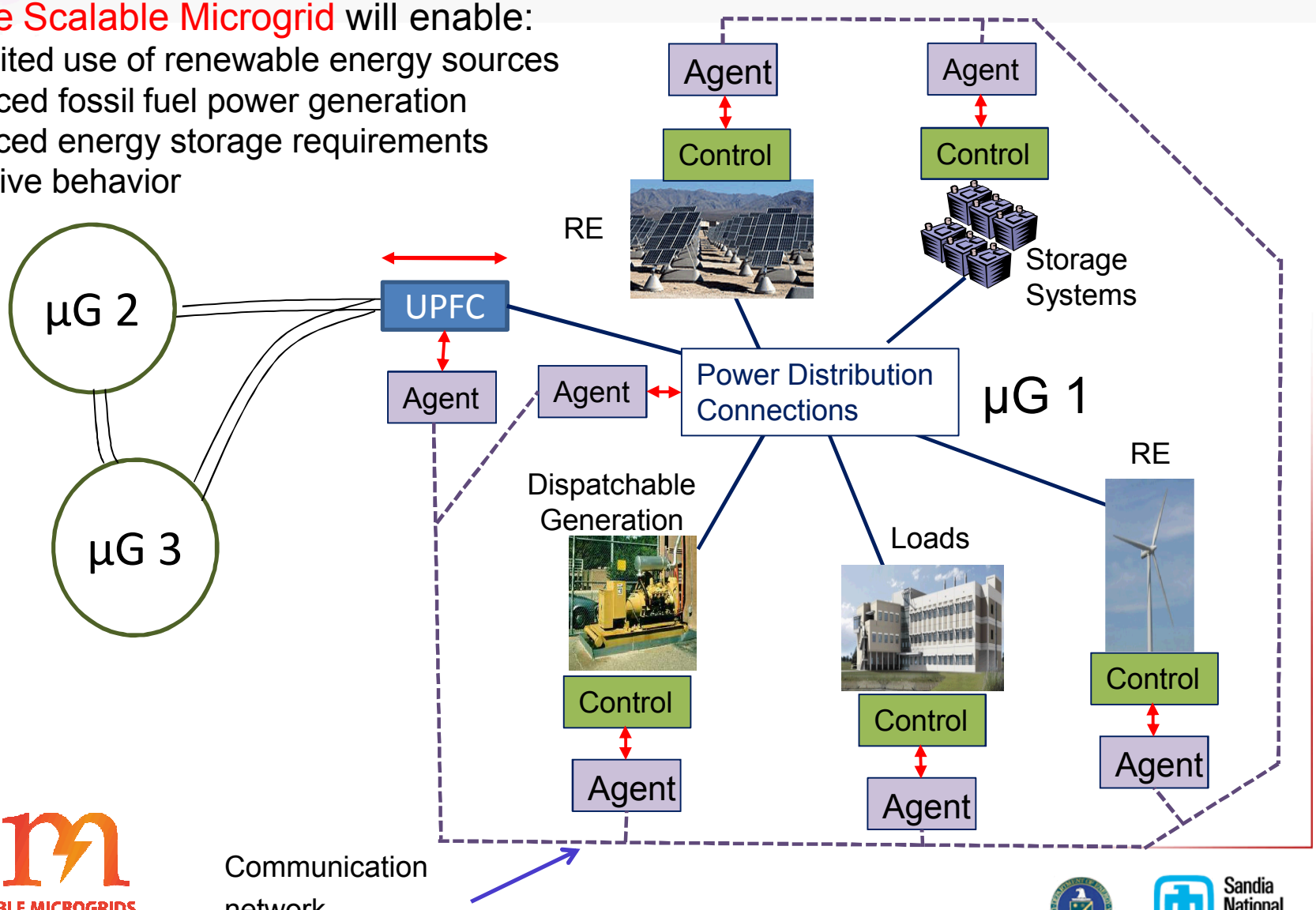
Self-Adapting, Self-Healing Electrical Microgrids are being developed based on advanced control and agent theory

Secure Scalable Microgrid will enable:

- Unlimited use of renewable energy sources
- Reduced fossil fuel power generation
- Reduced energy storage requirements
- Adaptive behavior



SSM
SECURE SCALABLE MICROGRIDS
It's the end of the grid as we know it

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