HGEO's Engagement in the HPC4EI Program: High-Performance Computing for Industry Problem Solving

Pavan Ravulaparthy, Ph.D.
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U.S. DEPARTMENT of ENERGY | Hydrocarbons and Geothermal Energy Office

About HGEO

The mission of the Hydrocarbons and Geothermal Energy Office (HGEO) is to unleash the full potential of America's hydrocarbon and geothermal resources to provide affordable, reliable, and secure energy.

Through applied innovation and U.S. energy leadership, HGEO develops and advances breakthrough technologies that lower costs and power American prosperity, freedom, and human flourishing.

By leveraging America's hydrocarbon and geothermal resources, HGEO works to enhance reliable baseload power, strengthen grid reliability, and improve long-term energy security for communities nationwide.

These activities are pursued in partnership with the National Energy Technology Laboratory (NETL), DOE's only government-owned, government-operated National Laboratory focused on advancing the nation's energy future.

The Core Mission

The Challenge:

Materials for Extreme Environments:

Our energy future depends on materials that perform in:

- High-temperature
- High-pressure
- Corrosive environments

The Bottleneck: Time & Cost

Accelerating the Pace of Innovation:

Traditional R&D v/s HPC-Enabled Design

Traditional "make and break" material development is too slow and expensive.

Traditional R&D

- **Timeline:** `---------->`
- **Process:** Design (⚙️) → Build (🔨) → Test & Fail (💥) → [Repeat 2x]
- **Labels:** Time: Months to Years | Cost: $$$$$

HPC-Enabled Design

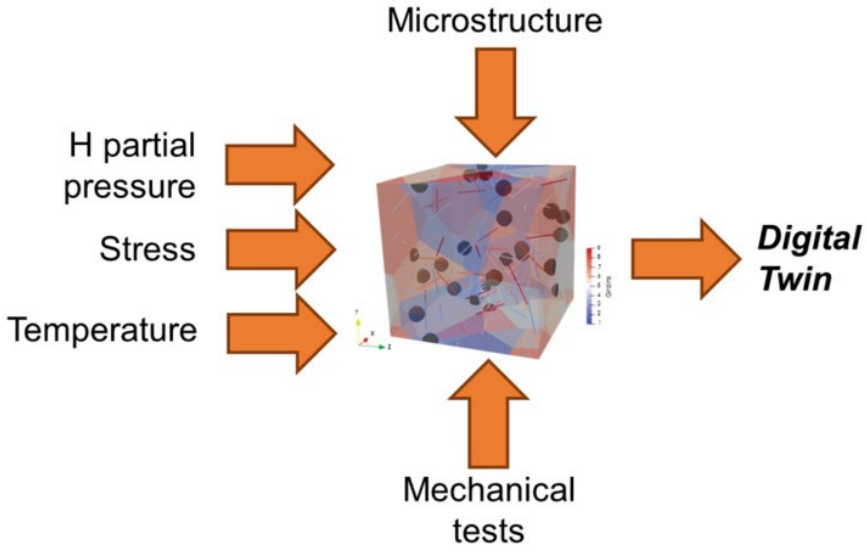
- **Timeline:** `---------->`
- **Process:** Design (⚙️) → Simulate & Optimize (💻) → Validate (✅)
- **Labels:** Time: Weeks to Months | Cost: $$

Our Strategy

The HPC4Mtls Program:

Creating the "Digital Twin"

We connect industry partners with DOE labs to computationally link a material's microstructure to its real-world performance.



A Case Study in Investment:

The Spring 2024 Solicitation: Investing in U.S. Energy Security

With $1.2M in program funds, we targeted key strategic goals for the nation's energy and manufacturing sectors.

Strategic Selections:

- **Enhancing Energy Efficiency:**
  - RTX & ANL: Improving gas turbine efficiency through advanced cooling simulations.
- **Strengthening Domestic Supply Chains:**
  - DNV & NETL: Accelerating the design of specialized domestic alloys for extreme service environments.

Making It Happen: The Funding Mechanism

How We Invest:

The Spring 2024 Solicitation

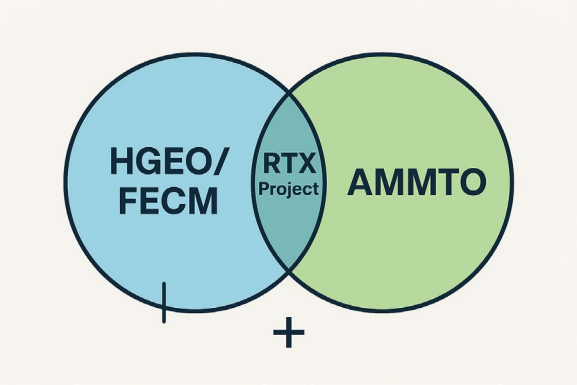
We strategically directed $1.2M in prior-year funds to these high-priority materials challenges.

A Force Multiplier:

The Power of Co-Funding:

Doing More with More

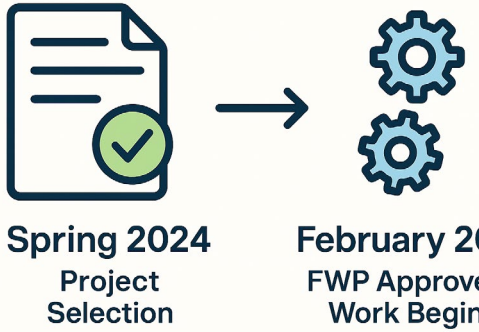
By partnering with the Advanced Materials and Manufacturing Office (AMMTO) to co-fund the RTX turbine efficiency project, we freed up our own funds.



From Proposal to Progress

A Clear Path from Selection to Execution

The Field Work Proposal for the RTX project was formally approved this time last year, demonstrating a clear and effective process for project initiation.



Conclusion

A Proven Model for Industrial Innovation:

- We strategically invest in key energy challenges.
- We leverage the HPC-to-AI pipeline for tech transfer.
- We collaborate across DOE to maximize impact.

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Questions?