Outline – UC Davis GATE Center

- Brief History
- Main Goal & Objectives
- Focus research areas
- Classes
- Outreach and Publications
- Application Process
- Graduate Research Projects
- Summary
The Merging of the GATE Centers at UC Davis

GATE Fuel Cell Center of Excellence 1999-2004

GATE Hybrid Electric Vehicle Center of Excellence 1999-2004

Fuel Cell, Hydrogen, & Hybrid Vehicle (FCH2V) Center of Excellence

2005-2010
FCH\textsuperscript{2}V Goals & Objectives

Goals:
- Train future engineers to ensure the United States remains competitive
- Conduct research in the area of advanced automotive technology

Objectives:
- Support research of FCH\textsuperscript{2}V technology (graduate fellowships, selected with a competitive proposal process)
- Support dissemination of FCH\textsuperscript{2}V research results & knowledge (publications, outreach and workshops)
- Support curriculum development around FCH\textsuperscript{2}V technology (expand and enrich course offerings)
- Support industrial/government collaboration of FCH\textsuperscript{2}V technology (workshops, graduation placement, internships)
Cross Training for Transportation Leaders

Collaboration of Departments: ITS and College of Engineering

- Emissions Control
- Aerodynamics
- Transmissions
- Internal Combustion
- Advanced power cycles
- Batteries and Capacitors
- Energy and Transportation Policy
- Hydrogen Production
- Energy Efficiency
- Life-Cycle Analysis
- Instrumentation
- Fuel Cell Chemistry
- Hybridization
FCH²V Center Research Areas

- Fuel Cell and Hybrid Component Level Research
  - Energy storage (batteries, ultracapacitors)
  - Continuously variable transmissions (CVT)
  - Emissions reduction with hybrid and hydrogen enabled technologies
  - Electronic Control systems

- Vehicle and Energy Systems Research
  - Vehicle systems modeling
  - Fuel cell auxiliary power units
  - System Integration
  - DOE Challenge X competition (Trinity)

- Fuel Pathway Analysis (STEPS Program)
  - Infrastructure economics
  - Environmental analysis
Leverages Existing Programs & Partners

- H₂ Production & Utilization Laboratory

- H₂ Pathways and STEPS Programs
  [http://steps.its.ucdavis.edu/](http://steps.its.ucdavis.edu/)

- UC Davis Challenge X Team
  [http://www.team-fate.net/](http://www.team-fate.net/)

- FC Auxiliary Power for Trucks
Research and Training Facilities

- Hybrid Vehicle Power Systems Lab (ITS-Davis)
- Hybrid Vehicle Design, Assembly and Test Labs (MAE)
- Hydrogen Production and Utilization Lab (MAE)
- On-campus Hydrogen Refueling Station (ITS-Davis)
FCH²V Center Curriculum

• Advanced Energy Systems (Course and Lab)
• IC Engines (Course and Lab)
• Hydrogen Pathways – Technology, Pathways, Economics and Policy
• Fuel Cell Systems
• FCH²V Center Electives, 40 classes available:
  ▪ Mechanical and Aeronautical Engineering (MAE)
  ▪ Chemical Eng. and Materials Science
  ▪ Biological Systems Engineering
  ▪ Electrical Engineering
  ▪ Transportation Technology and Policy (ITS-Davis graduate group)
Outreach and Publications

Comprehensive website for outreach purposes and as a research collaboration tool

http://gate.its.ucdavis.edu
Application process

1. An updated CV
2. Current academic transcript
3. Complete twelve month research plan
4. Letter of sponsorship from a participating professor
Research Plan Components

1. Research plan description
2. Expected contributions
3. Research Methodology
4. Literature review
5. Timeline and Deliverables
6. Interim publications
7. Interaction with other researchers
8. Personal Education Plan (as it relates to the research)
9. List of advisors and role each one will play in your research, including outside (non-academic) contacts
GATE Graduate Fellowships

Competitive Award 2008 - 2009

- Douglas Saucedo – Electric-Turbo-Generator (ETG) Internal-Combustion-Engine (ICE) Modeling for Drive-Trace Vehicle Simulations
- David Kashaveroff – An Investigation of Stratified and Hybrid Mode Reformation for Fuel Cell Applications
- Jason Greenwood - Hydrogen Enriched Mixed Alcohol Combustion in IC engines

Applications due April 15, 2009 for the 2009-2010 academic year
GATE Graduate Fellowships

Competitive Award 2005 - 2006

• David Vernon - Hydrogen Enrichment Via Chemical Recuperation to Increase Efficiency and Reduce Emissions in Engines.


• Matt Caldwell – Hydrogen Production from Unpurified bio-derived alcohol mixtures: fundamental investigation of ATR and economic and infrastructure pathway analysis

Competitive Award 2006 - 2007

• Eddie Jordan - Hydrogen enriched ethanol combustion in IC engines
  • Nils Johnson - Potential for coal-derived hydrogen with CCS
  • David Vernon – Thermal integration and system design for utilizing waste heat and exhaust gases
  • Jonathan Woolley - Characterizing the hydrogen conversion trends associated with auto thermal reformation of octane ethanol mixtures.
GATE Graduate Fellowships (Continued)

Competitive Award 2007 - 2008

- Andrew Shabashevich – Analysis of Waste Heat Recovery from Light-Duty Hybrid Electric Vehicles
- David Vernon – Thermal integration and system design for utilizing waste heat and exhaust gases
- Eddie Jordan - Hydrogen enriched ethanol combustion in IC engines
- Wayne Leighty - Structural Econometric Modeling of the Investment Timing Game in Alaska Oil and Gas Exploration and Development
## UC Davis GATE Students

<table>
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<th>GATE Center (Year)</th>
<th>M.S. Candidates</th>
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Organizations that hired graduates:
UTC Fuel Cells, Ballard, Daimler, General Motors, Ford, Nissan, Toyota, Volkswagen, Agilent, ISE Corp., Aerojet, Electric Power Research Institute (EPRI), United Defense, Eaton, California Fuel Cell Partnership (CaFCP), IAV Automotive Engineering Inc., REII,
Summary / Key Lessons

• GATE program has expanded and strengthened the automotive technology research and education programs at UC Davis

• Leveraging with other programs allows for increased resources for research and strong interaction with other researchers

• Competitive process for student research awards works very well

• GATE builds human infrastructure
FCH²V GATE Center - Building human infrastructure