



Advanced boost system development for diesel HCCI/LTC applications

2008 DOE Peer Review

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Outline of the presentation



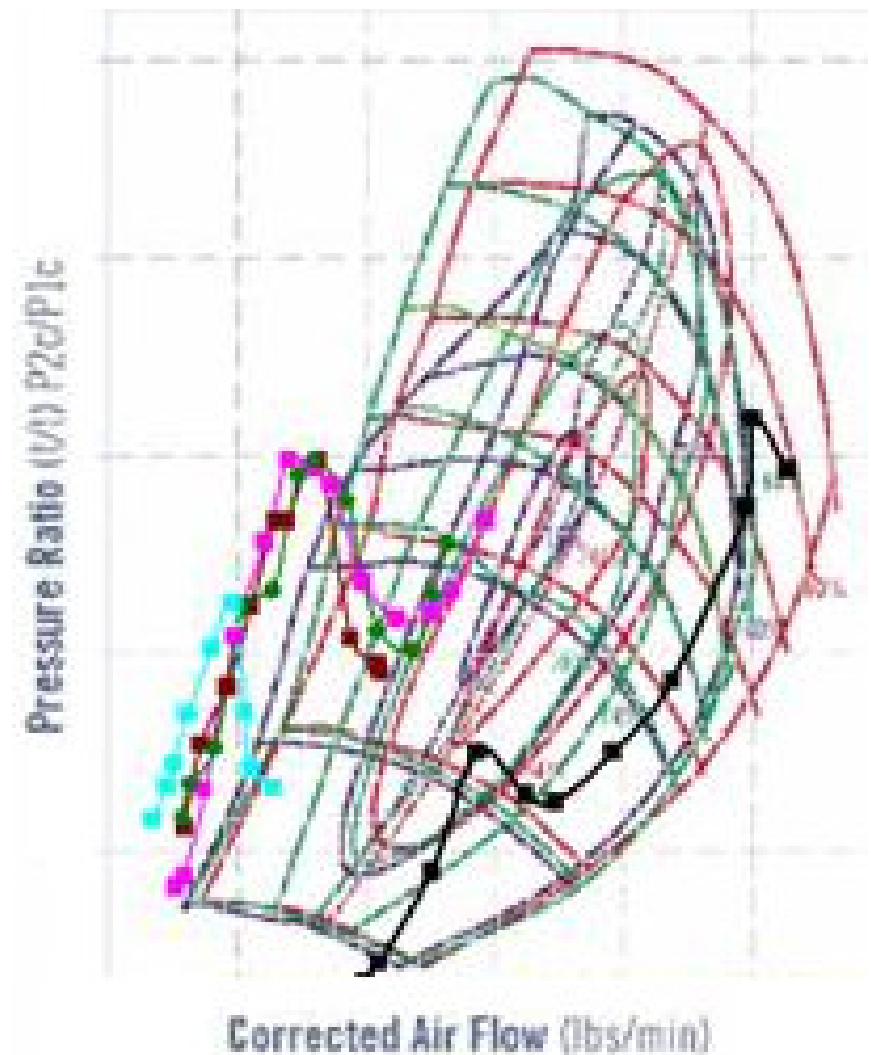
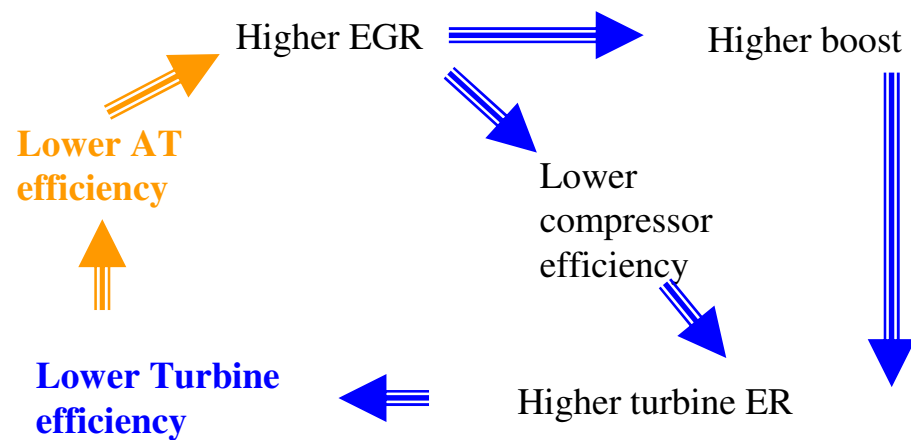
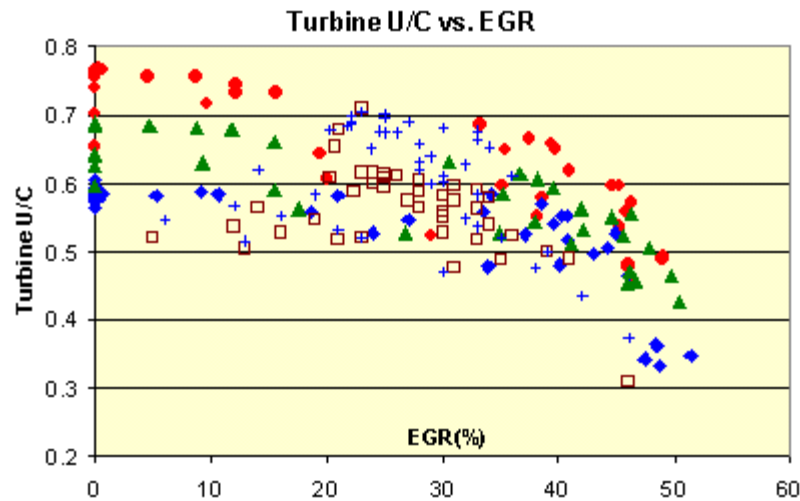
- Purpose of work
 - Explore advanced boost technologies to support clean diesel combustion, such as HCCI/LTC applications
- Technical challenges in diesel HCCI/LTC applications
- Approaches to address boost requirement
- Program milestones
- Program target



Purpose of Work



- Provide high level of EGR that is required for light duty, clean diesel combustion like HCCI/LTC
- Improve compressor and turbine efficiencies in the customer driving cycles where heavy EGR is deployed
- Minimize fuel economy penalty and aftertreatment efficiency penalty due to high EGR usage at part loads
- Surge control during tip-out



Technical Challenges !!!

For diesel HCCI, LTC

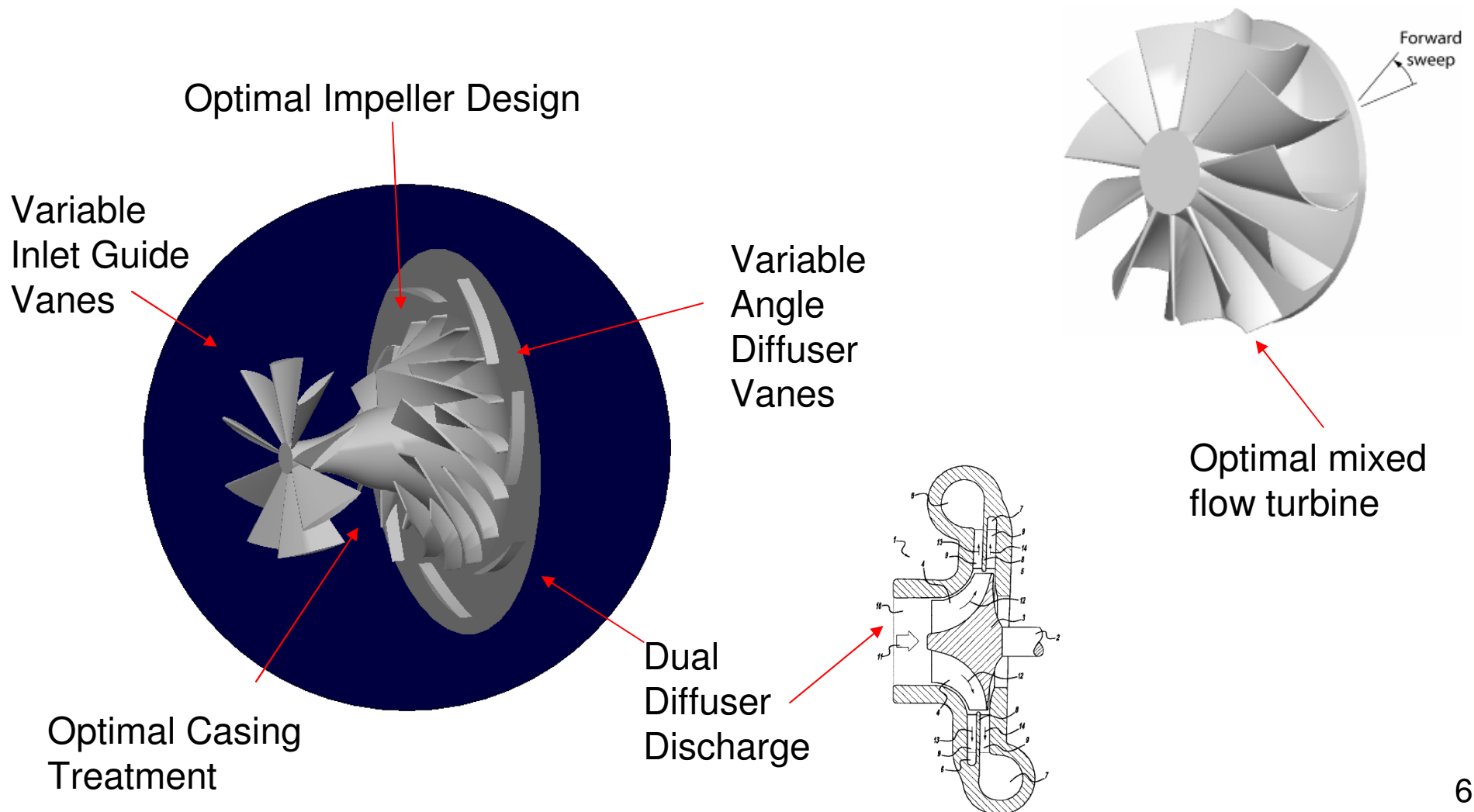


Barriers



- Heavy cooled EGR is needed for all diesel HCCI/LTC
- Heavy EGR is accompanied by loss of efficiencies in compressor and turbine
- Heavy EGR and low airflow through compressor (for high pressure EGR) pushes operation point close to compressor surge, esp. during tip-out
- Low oxygen content in the intake and poor turbo efficiency compromise diesel transient response

Strategies for Wide Range Turbocharger





Program Milestones



- 10/1/2007-12/31/2007: cascade subsystem requirements; agree on boundary conditions
- 1/1/2008-5/31/2008: 1D simulation and optimization of compressor and turbine aerodynamics design;
- 6/1/2008-12/31/2008: 3D CAD/CAE/CFD
- 11/1/2008-3/1/2009: control system development
- 1/1/2009-6/30/2009: fabrication and bench validation
- 7/1/2009-12/31/2009: refinement of design and flow bench validation
- 1/1/2010-7/1/2010: engine dynamometer demonstration



Program Target



- 10% improvement in turbocharger efficiency on customer driving cycle
- 20-40% improvement in surge margin from current vaneless radial flow turbochargers
- Demonstration of Tier II Bin 5 emission compliance on a light duty diesel engine

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