Flow Reactor Studies of Surrogate Jet Fuel Reaction Kinetics

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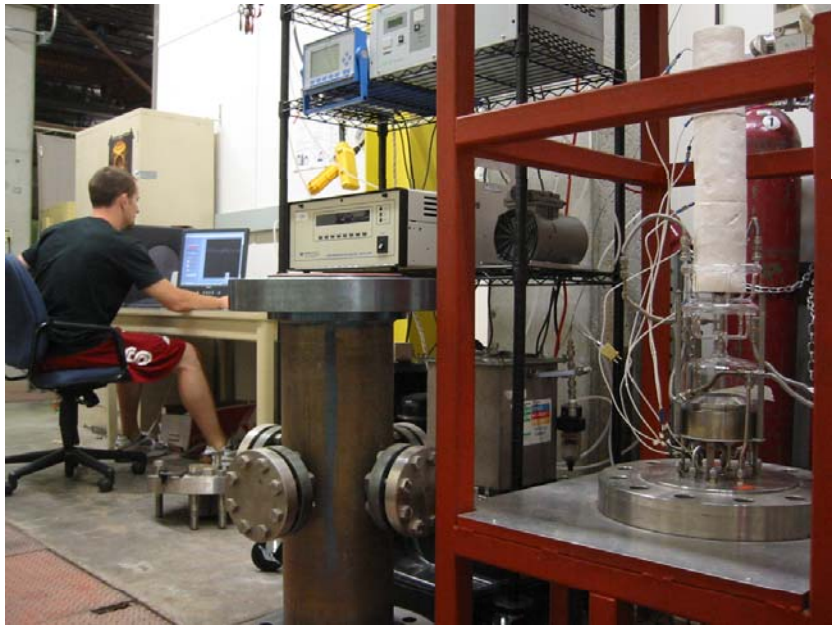
- Project Objectives
- Experimental Techniques
- Application to Fuel Kinetics Studies
- Future Directions: Flow Reactor Research

Sponsor: AFOSR/USC

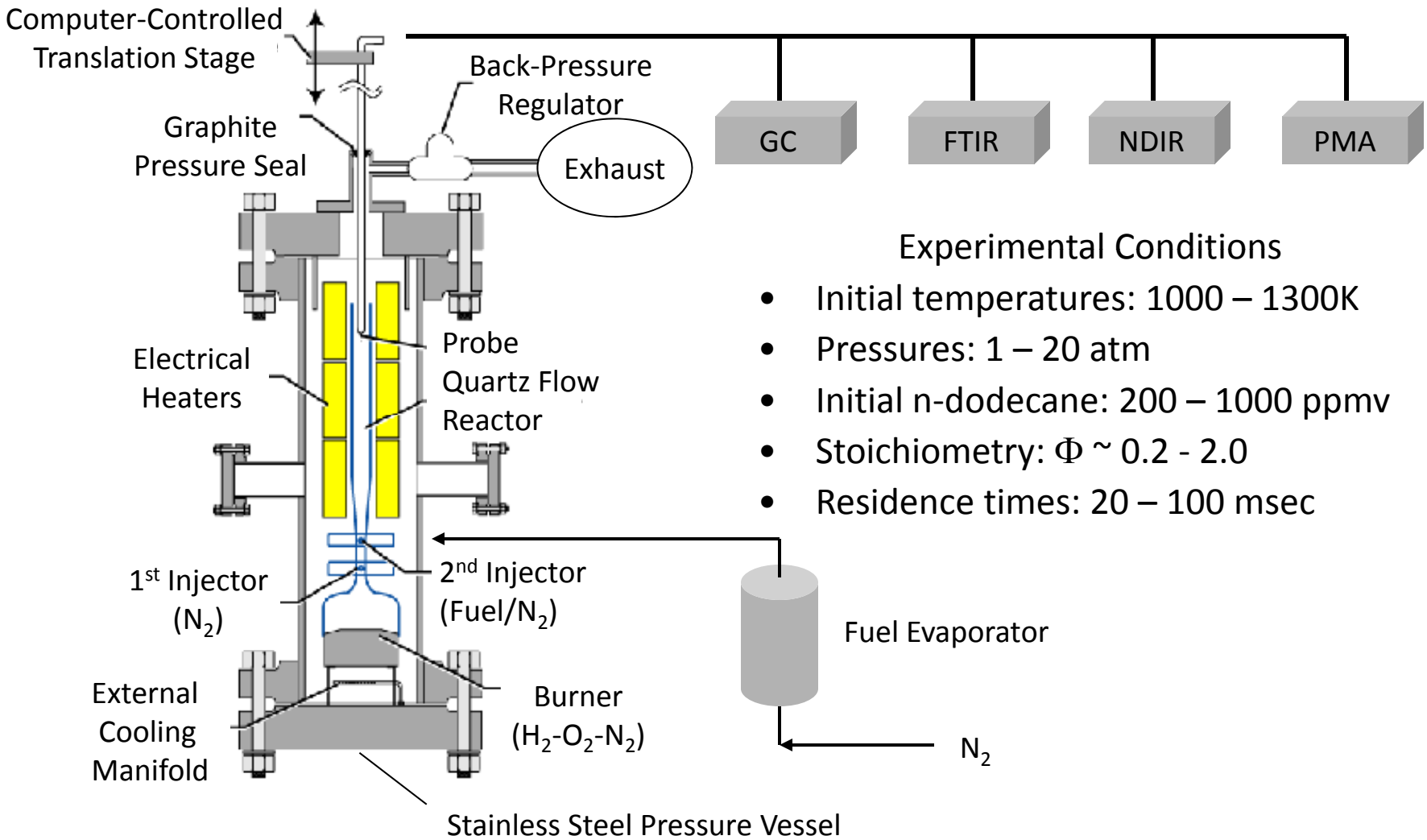
Long-Term Stanford Program Objectives

- Build an accurate, multi-target, multi-species experimental database for combustion of *practical jet fuels and surrogates* utilizing a flow reactor and shock tubes.

- Collaboratively develop, evaluate and refine *detailed kinetic mechanisms* for single-component fuels, multi-component surrogate blends, and practical fuels to establish *predictive capabilities* for the kinetics of current and future jet fuels.



Stanford Flow Reactor

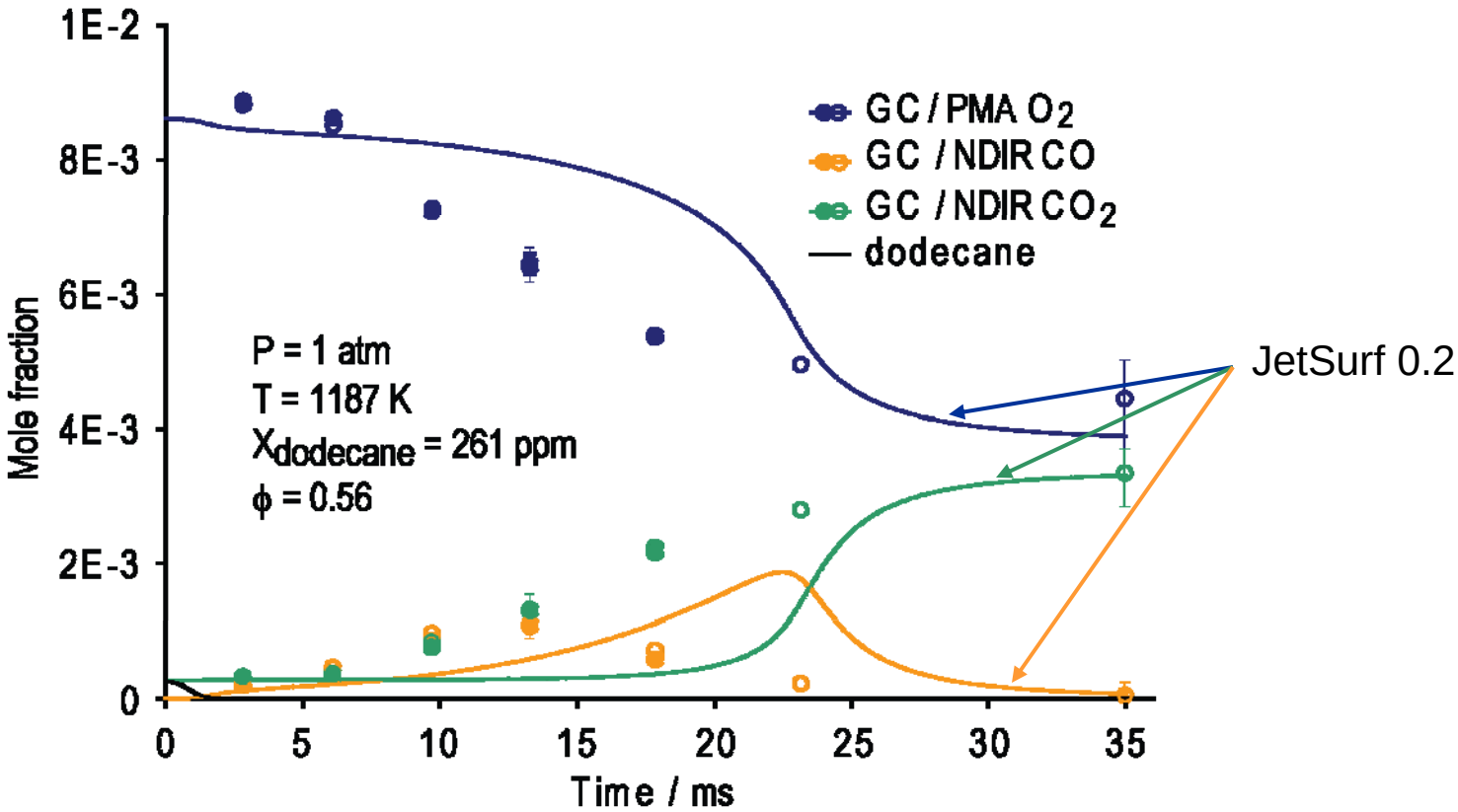


Experimental Conditions

- Initial temperatures: 1000 – 1300K
- Pressures: 1 – 20 atm
- Initial n-dodecane: 200 – 1000 ppmv
- Stoichiometry: Φ ~ 0.2 - 2.0
- Residence times: 20 – 100 msec

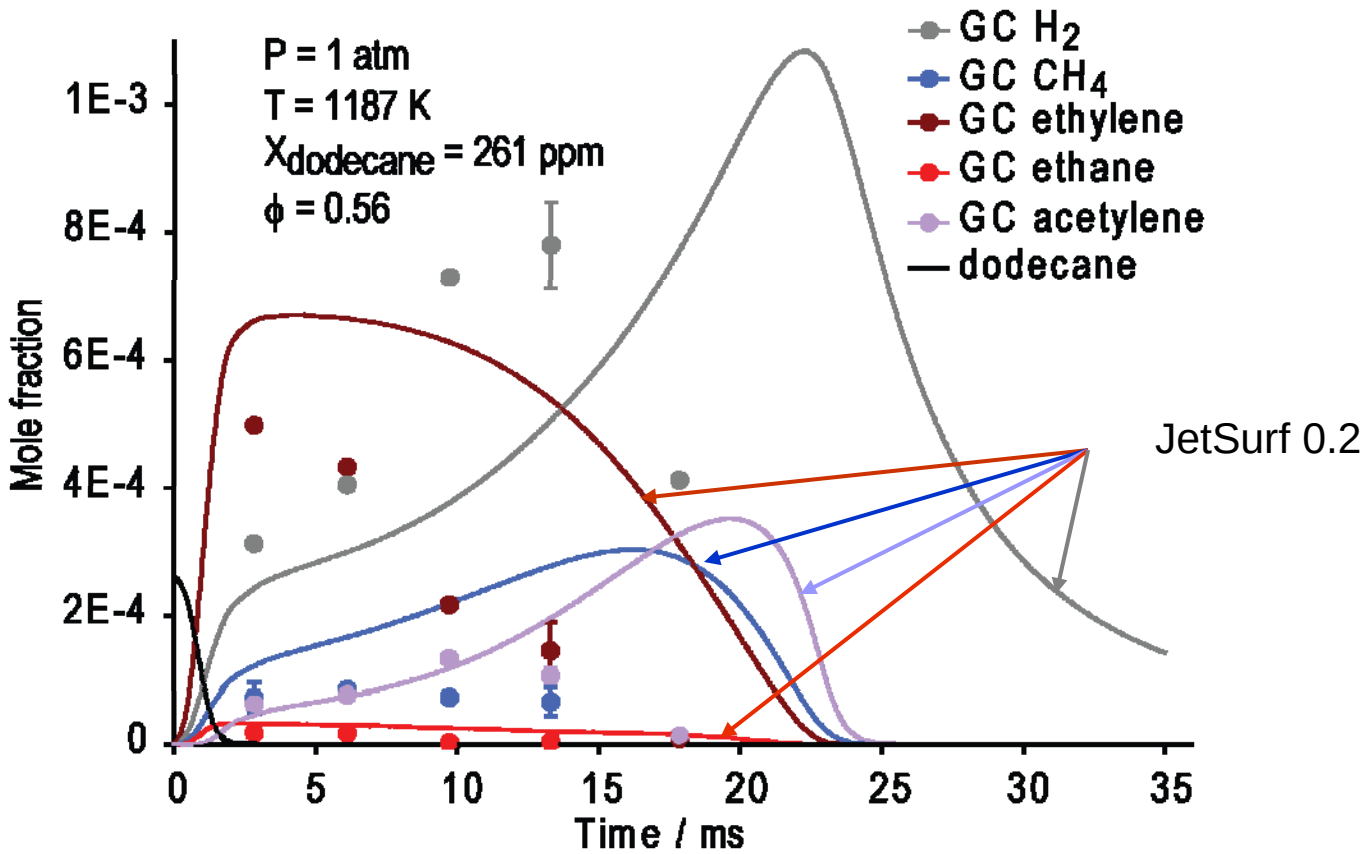
Major Species Profiles

- Comparison of data and JetSurf 0.2 simulations
- Duplicate runs and different species analyzers demonstrate experimental repeatability
- Measured reaction time scales are shorter than model predictions

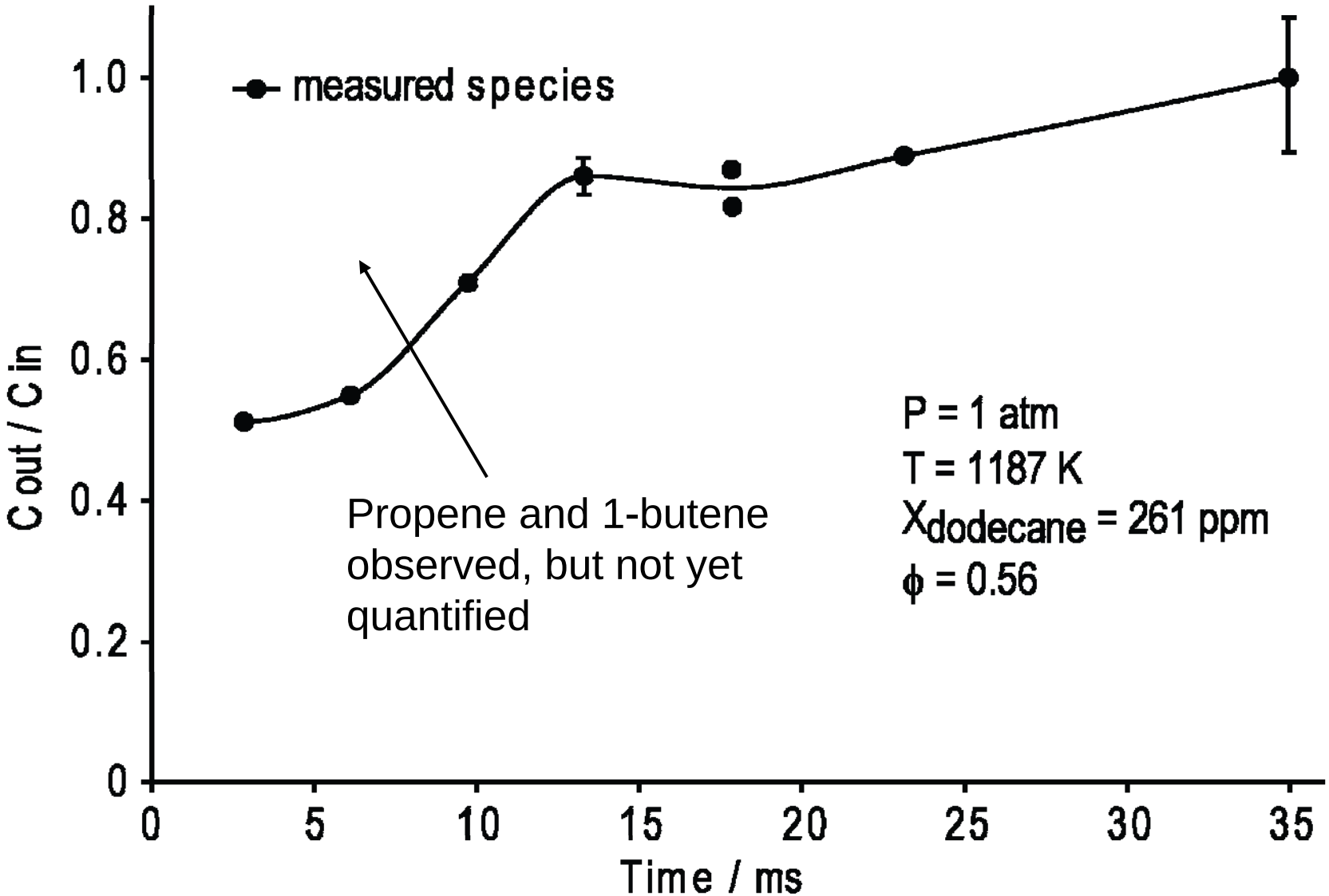


Minor Species Profiles

- Comparison of data and Jet Surf 0.2 simulations
- Initial stages of reaction are dominated by formation of smaller hydrocarbon species and hydrogen
- Removal of these minor species is faster than predicted by JetSurf 0.2



Carbon Balance



Accomplishments/Future Work

- Initial experiments conducted at temperatures intermediate between the Drexel flow reactor and Stanford shock tube.
- Comparison of data and model results shows a discrepancy in measured and computed time scales.
- Data from all three experiments provide targets for improvements in JetSurf.
- Flow reactor conditions will be expanded to higher and lower temperatures and to elevated pressures.