

# ASCENT Project 51

## Combustion Concepts for Next-generation Aircraft Engines



### Massachusetts Institute of Technology

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### Objective:

Compare performance impacts and emissions-reduction potential of new **fuel types, engines** and **combustion concepts**

Develop and utilize in-depth engine cycle and chemistry models to evaluate impact of new combustion technologies on emissions.

### Project Benefits:

Co-optimization of engine cycle and combustor can yield better efficiency and emissions, leading to greater long-term environmental sustainability as well as economic benefits for the aviation sector

### Research Approach:

This project involves three steps:

- **Engine cycle analysis** – Study change in cycle performance with new technological concept at the system level
- **Combustor analysis** – Use cycle parameters and determine impact of new technology on emissions
- **Mission analysis** – Analyze trade-off between fuel penalty and emission reduction to evaluate feasibility for different missions

### Major Accomplishments (to date):

The impact of water injection on engine performance and total NO<sub>x</sub> emissions was evaluated for various missions and injection strategies on conventional rich front-end and lean-burn engines. For the staged combustor, different fuel staging strategies were tested to minimize full-flight NO<sub>x</sub> emissions.

### Future Work / Schedule:

- Investigation of fuel composition and additives as means for emission reduction
- Evaluation of axially-staged combustor emissions characteristics