

## ASCENT Projects 91A and B

# Environmental Impacts of High Altitude and Space Vehicle Emissions

## Massachusetts Institute of Technology

PIs: Raymond L. Speth (MIT, ASCENT 91A)  
Donald J. Wuebbles (UIUC, ASCENT 91B)

PM: Jeetendra Upadhyay



### Objective:

- Estimate the environmental impacts of **near-future launch vehicle** emissions
- Evaluate uncertainty due to **model disagreement** through **multi-model analysis**
- Evaluate uncertainty in **growth and technology** through multiple scenarios

### Project Benefits:

- **First evaluation** of climate and air quality impacts for **plausible near-future launch vehicle scenarios**
- Inform **near-term decisions** regarding launch vehicle regulations and technology

### Research Approach:

- Develop **scenarios** of plausible, near-future launch vehicle operations out to 2050\*
- Convert scenarios into **gridded emissions inventories** of CO, CO<sub>2</sub>, NO, N<sub>2</sub>O...\*
- Simulate effects of emissions inventories on **global atmospheric composition** using the GEOS-Chem High Performance model
- Convert simulated output into **climate and air quality impacts** using both the **GEOS-Chem** (A91A) and **WACCM** (A91B) models

\* Through MIT subcontract to Aerospace Corporation

### Major Accomplishments (to date):

- Key scenarios identified
- Launch vehicle emissions modeled
- NetCDF-4 input files for simulations generated

### Future Work / Schedule:

- Multi-model intercomparison of launch vehicle impacts for 2050, including (*Winter 2023*):
  - Ozone layer destruction
  - Climate impacts (radiative forcing)
- Evaluation of impact sensitivity to launch location and context (*2024*)