



STRATOSPHERIC AND TROPOSPHERE AEROSOL EXPOSURE STUDIES (STAES)

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R&D Challenge

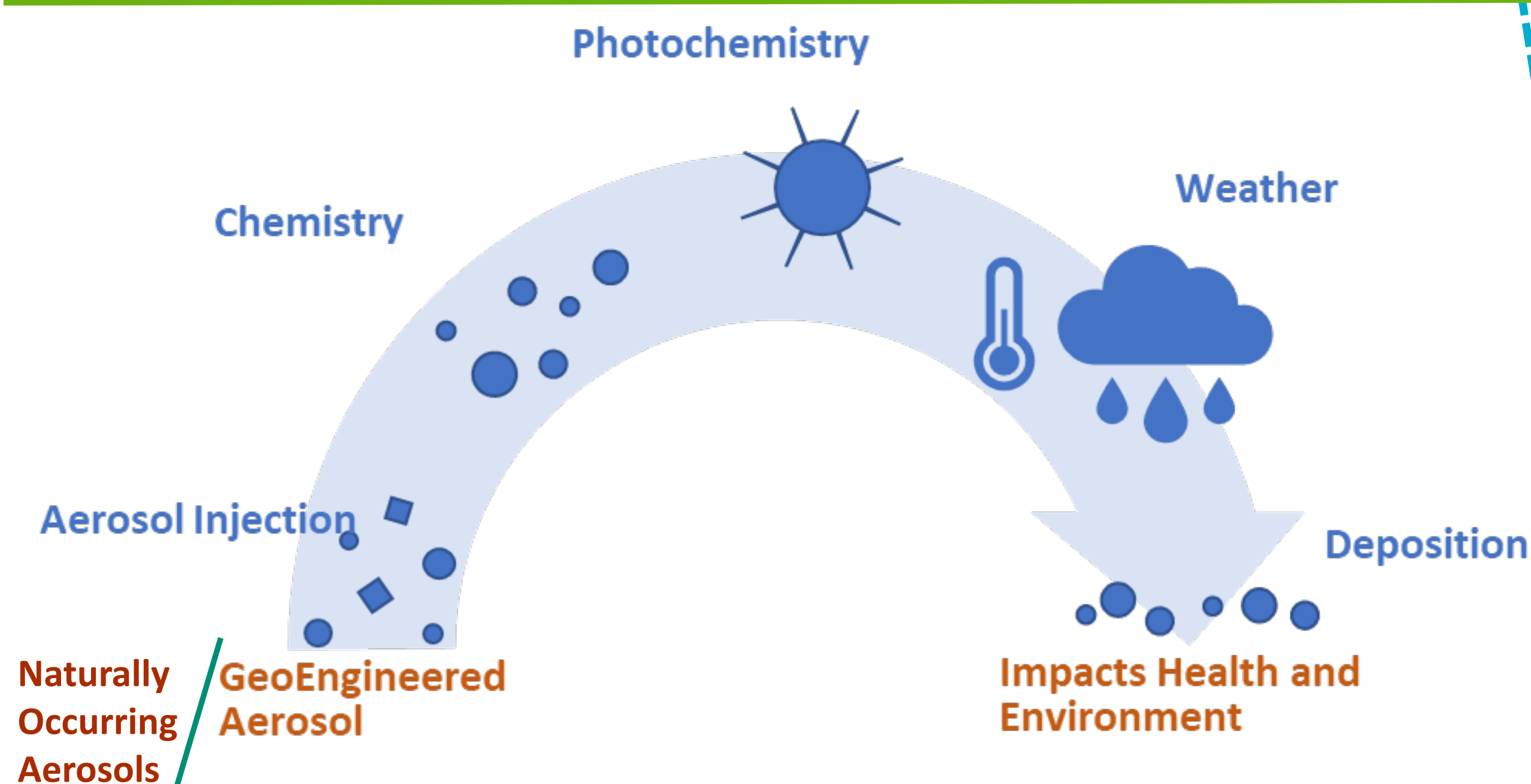
Approach

Impact & Benefit

Aerosols in the atmosphere are subjected to transformative weathering conditions that affect aerosol function and environmental impacts. A means is needed to experimentally determine the microphysical processes at play in order to fundamentally understand climate-relevant aerosol processes.

Engineer compact sample vessels that preserve the integrity of aerosol specimens during transport, and programmatically expose samples in situ. This will enable aerosol fate experiments without releasing aerosols into the environment in both the troposphere and stratosphere.

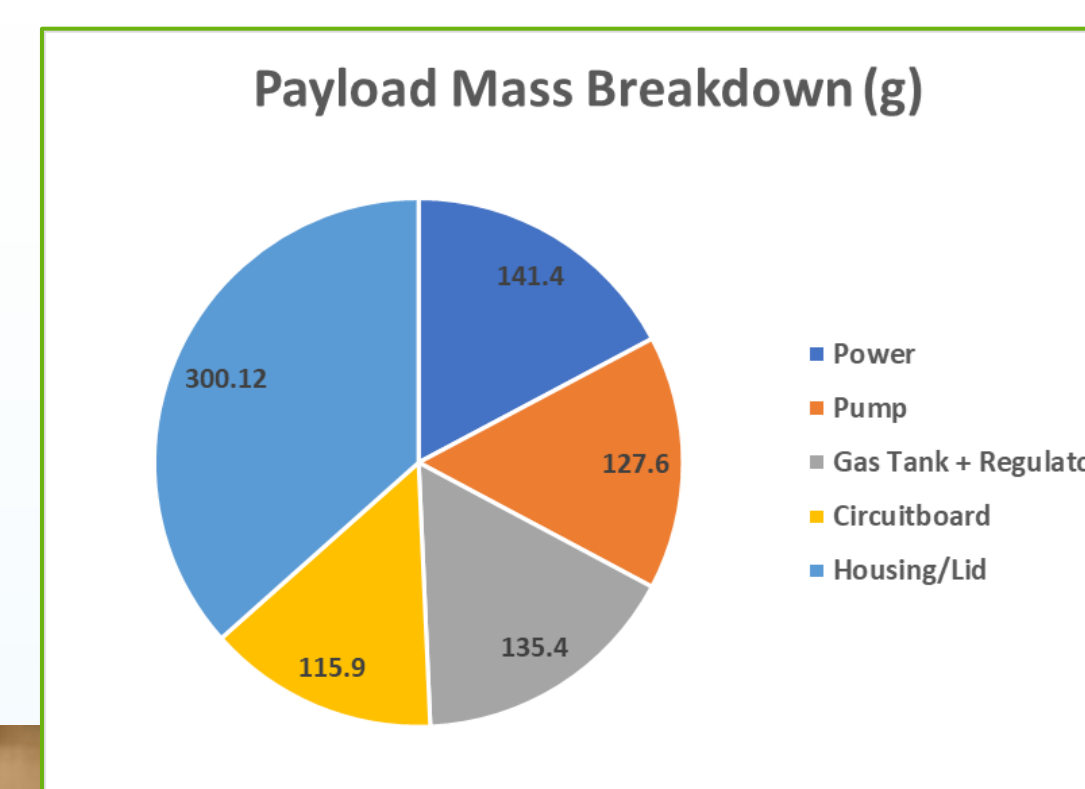
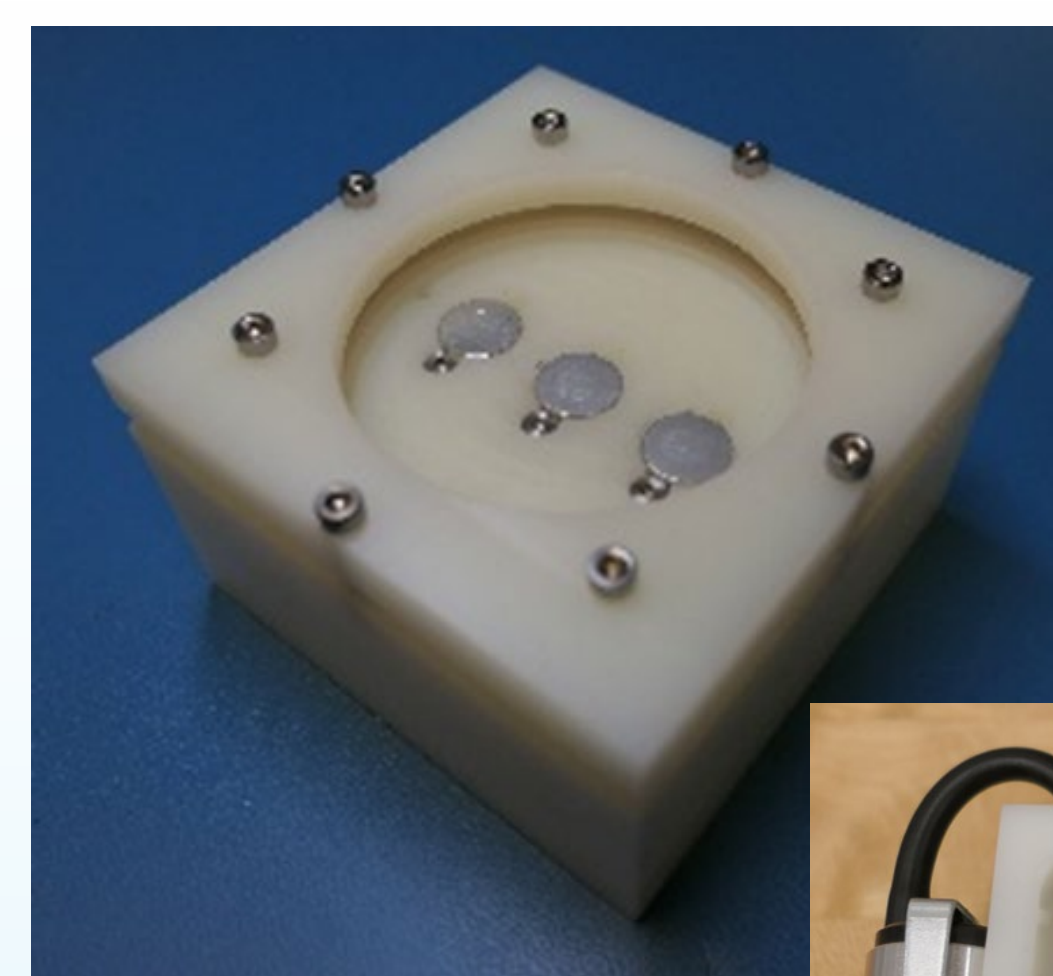
- Permits following aerosol materials from their unperturbed state to their processed form.
- Climate model parameterizations and uncertainty in aerosol effects are improved by understanding atmospheric processing in situ.
- Impacts of solar climate intervention approaches can begin to be quantifiably tested.



- Designed, built, and tested (ground and aloft) Sample Transport Exposure Vessel (STEVE)
- Functional STEVE enable exposure of samples aloft, triggered by pressure or time.
- Developed atmosphere-like chamber to enable rapid, ground-based qualification.

- We have designed and built a prototype chamber for exposing specimens to the atmosphere in situ.
- This capability enables future experiments designed to understand material-atmosphere microphysics:

STEVE



- Candidates for Stratospheric Aerosol Injection (SAI)
- Aging of natural aerosol materials
- Processes on aerospace materials/coatings

- Methods of solar climate intervention seek to cool the globe by injecting fabricated aerosols into the atmosphere.
- It is unknown how injecting engineered aerosols will impact Earth's weather and climate systems.
- What are the risks/benefits of injecting engineered aerosols, and *how do we empirically study this system?*