



Venus Aerosol and Cloud Simulator (VACS)

Venus Facilities Workshop for Mission Support

Presenter:

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Date: 30 November 2022

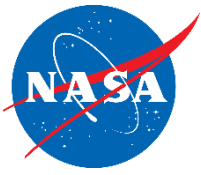
Time: 15:15 – 15:30 EST

Location: GRC Bldg. 162 Rm 302

Glenn Research Center at Lewis Field

21000 Brookpark Road

Cleveland, Ohio 44135



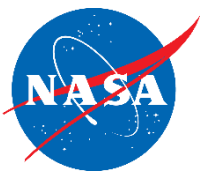
VACS Motivation and Objectives

Motivation:

1. Exploration technology for Venus' clouds require both short and long duration environmental testing
 - Many high-temperature materials may not be compatible with sulfuric acid and other trace active species
2. Fundamental processes in the Venus clouds have not yet been sufficiently measured or simulated
 - Precursor-condensate relationships, photochemistry, kinetic reaction rates, etc.

Objectives:

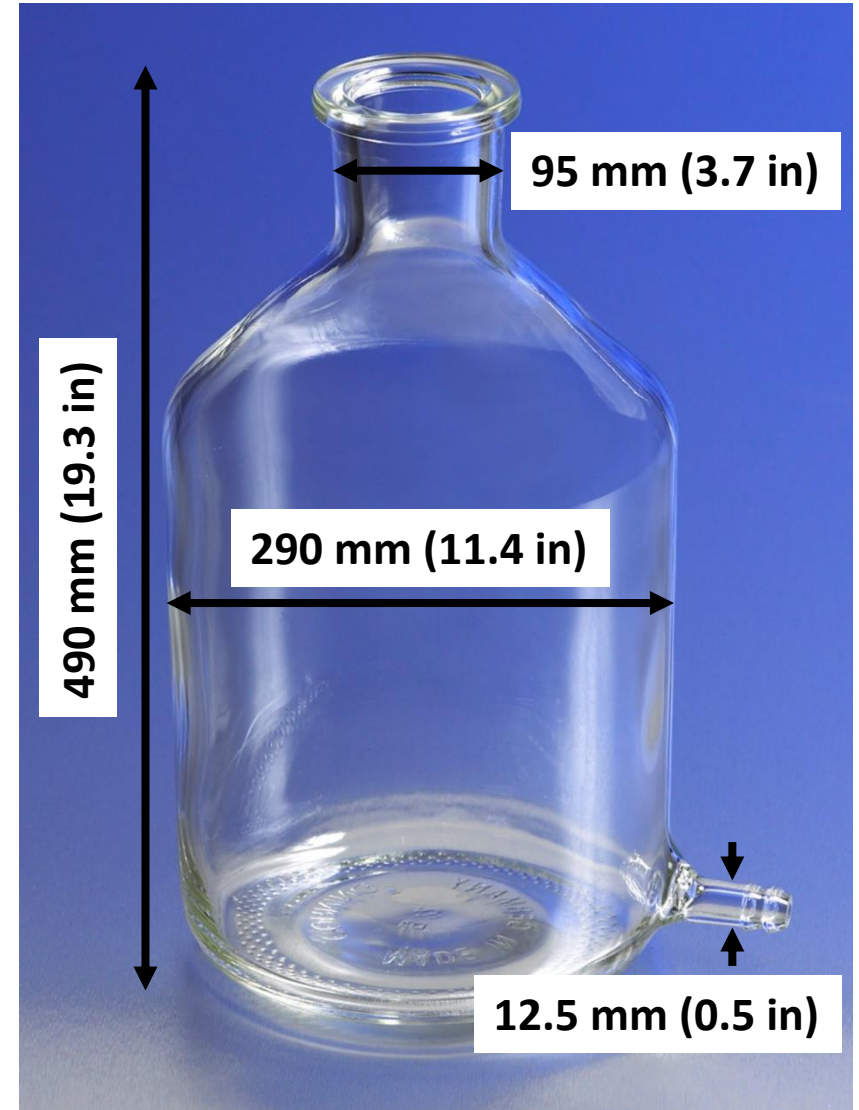
1. Sulfuric acid aerosol generation to support exposure testing of technology/hardware
2. Fundamental Venus cloud research on a small scale

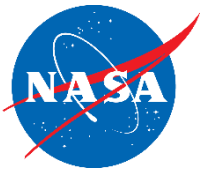


VACS Chamber Overview

Chamber Characteristics:

- Composition – Pyrex
- Volume – 19 L
- Max pressure – TBD (< 10 bar likely)
- Max temperature – TBD (insulation reduces visible access)
- Gas species – CO₂, N₂, SO₂, OCS, others TBD
- Electrical feedthroughs – Not currently, but possible
- Run time – TBD (likely < 10 h initially)
- Sampling port for instrumentation



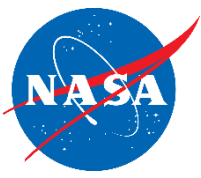


VACS Characterization

Initial Characterization Experiments:

- TSI 8108 large particle generator and 3330 optical particle counter to characterize chamber with KCl aerosol
 - 8108 generates polydisperse aerosol from 0.1 to 10 μm
- Modify 8108 to generate sulfuric acid aerosol
 - Add sulfuric acid compatible components
- Modifications to chamber could include:
 - Growth/coagulation chamber
 - Dilution
 - Particle sizer – MPASS
 - Particle impactor (size selection)

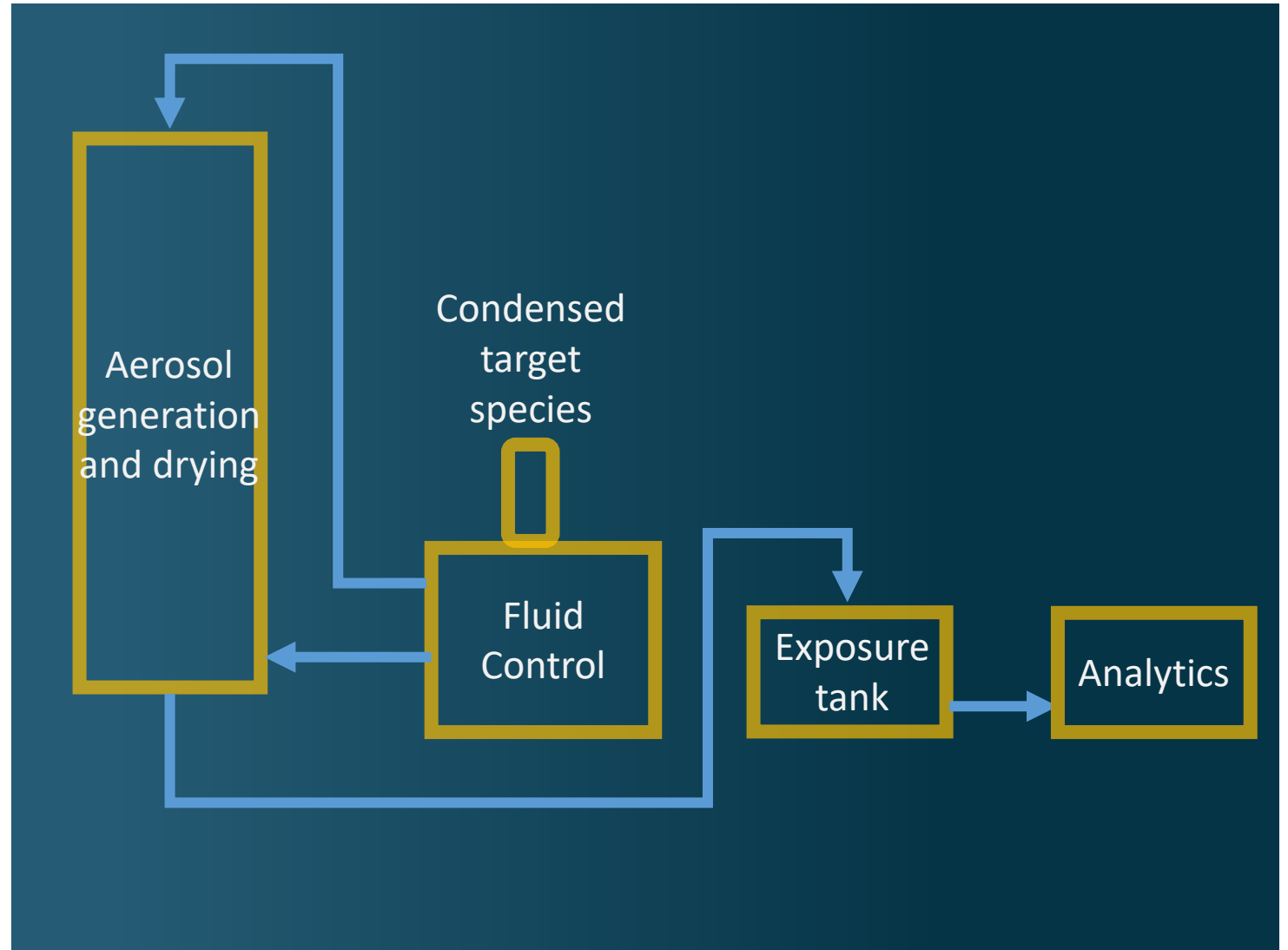


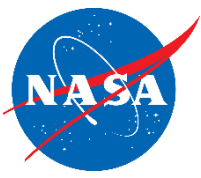


VACS Aerosol Generation Approach

Logistics:

- Facility not operational
 - Currently under development
 - Awaiting technical support for hardware configuration and gas supply connections to begin initial characterization tests
- Cost to operate facility is **TBD**
- Timeline to receive safety permit – ~2 months

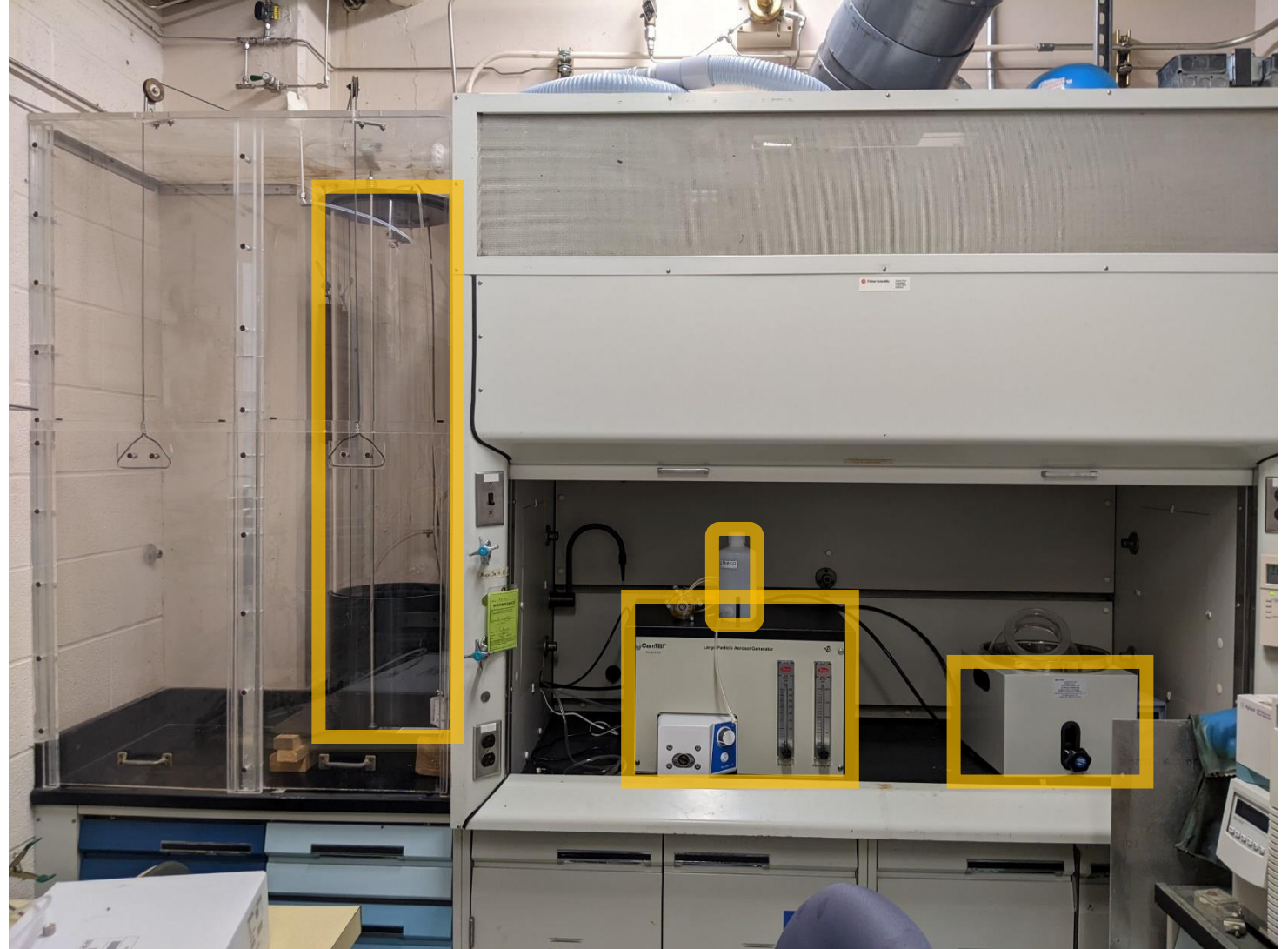


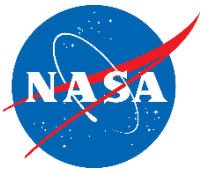


VACS Setup

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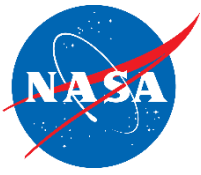
VACS – Potential Mission Support

Near-Term:

- Test infrastructure components and small instrumentation for short-duration exposure to Venus' cloud aerosols (e.g., DaVinci and Morningstar)
 - Limited to near-ambient pressures and temperatures
- Obtain laboratory measurements of spectrometry, kinetic rates, and particle morphometry to use as references for VERITAS, EnVision, DaVinci, etc. remote instrumentation

Intermediate and Far-Term:

- Sondes and intermediate descent-rate probes with new instrumentation
- Long-duration aerial platforms



THANK YOU

Comments/Questions/Suggestions?