

A Laboratory System for Simulation of Extreme Atmospheric Conditions in the Deep Atmospheres of Venus Jupiter, and Beyond

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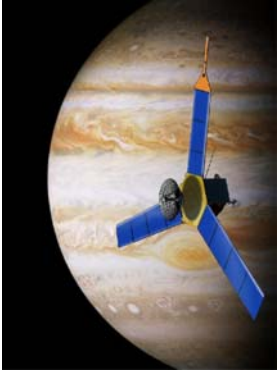
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SwRI

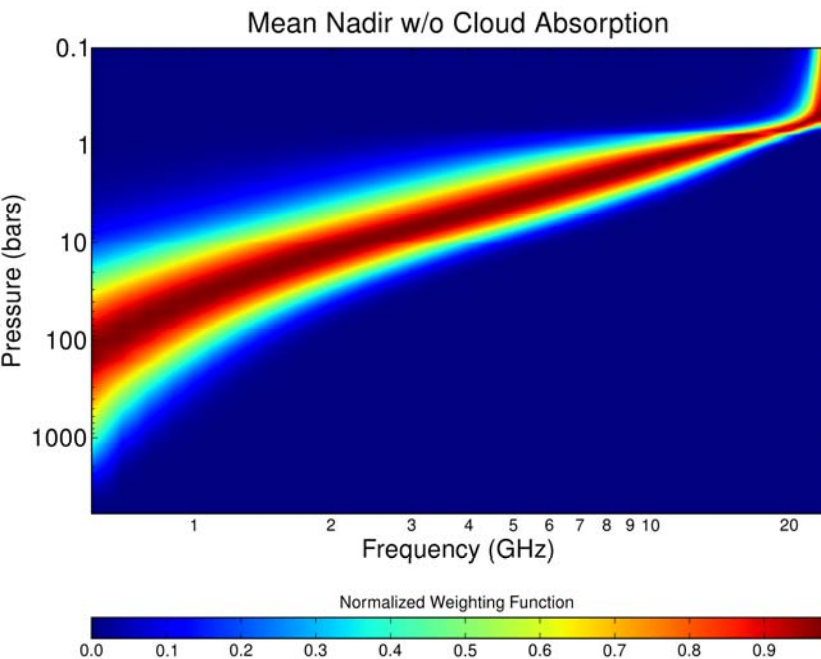
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Why? Juno MWR! Venus? Sure, why not?

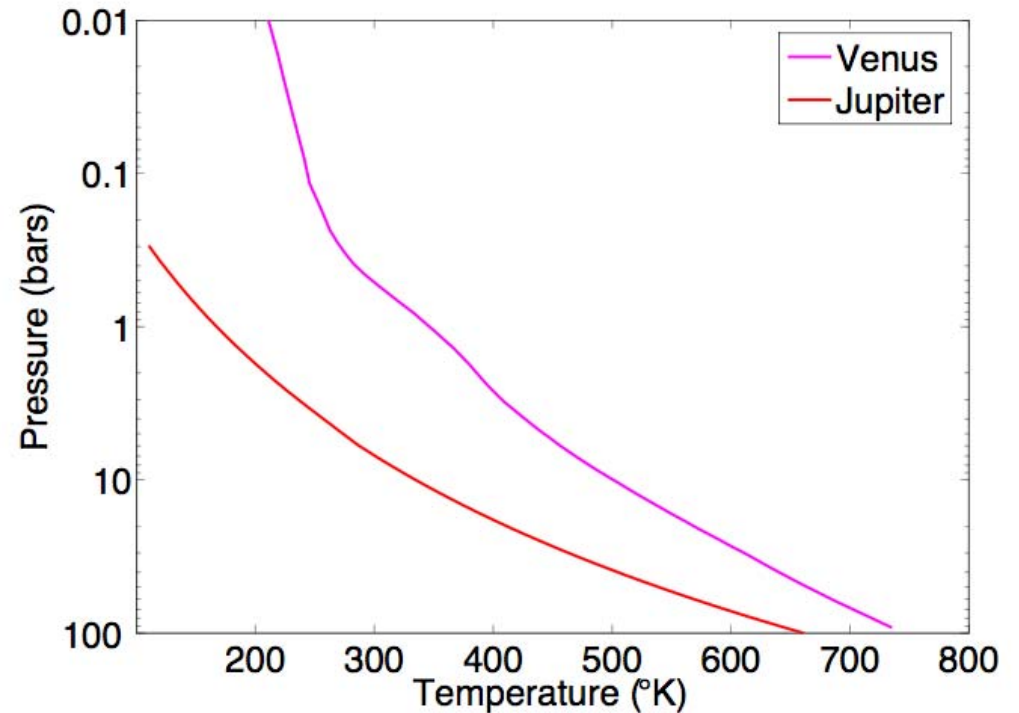


Juno MWR

- Highly elliptical orbit perijove ≈ 4500 km (from 1 bar level)
- 6 Channel microwave radiometer:
0.6, 1.25, 2.6, 5.2, 10, 22 GHz

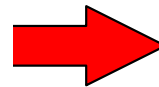
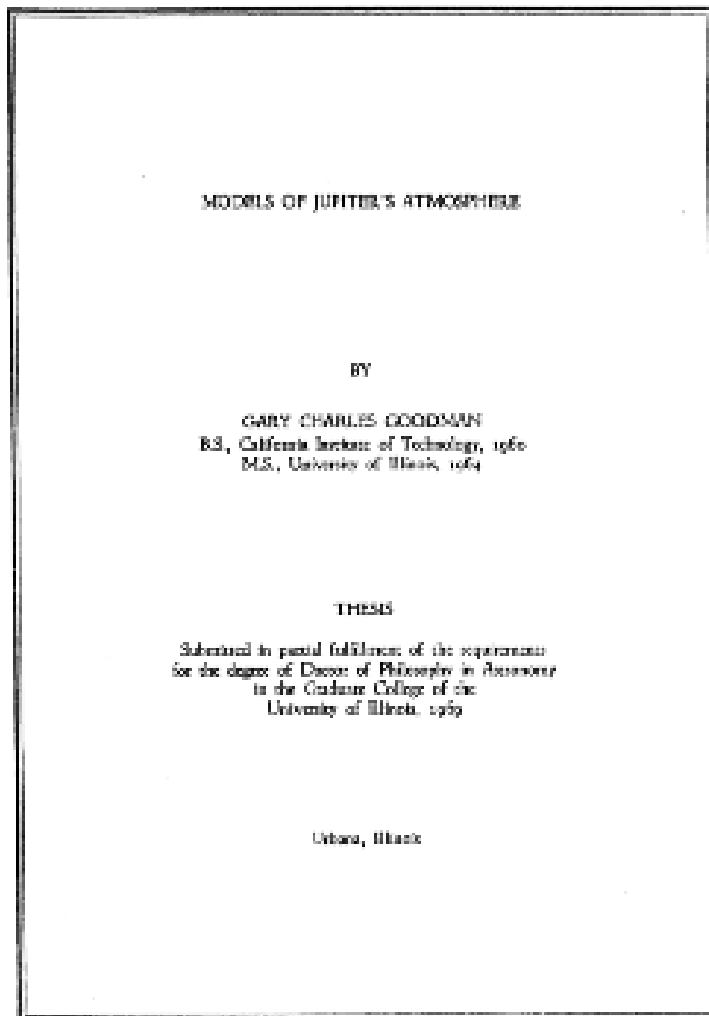


As computed by "Unofficial" Georgia Tech Model



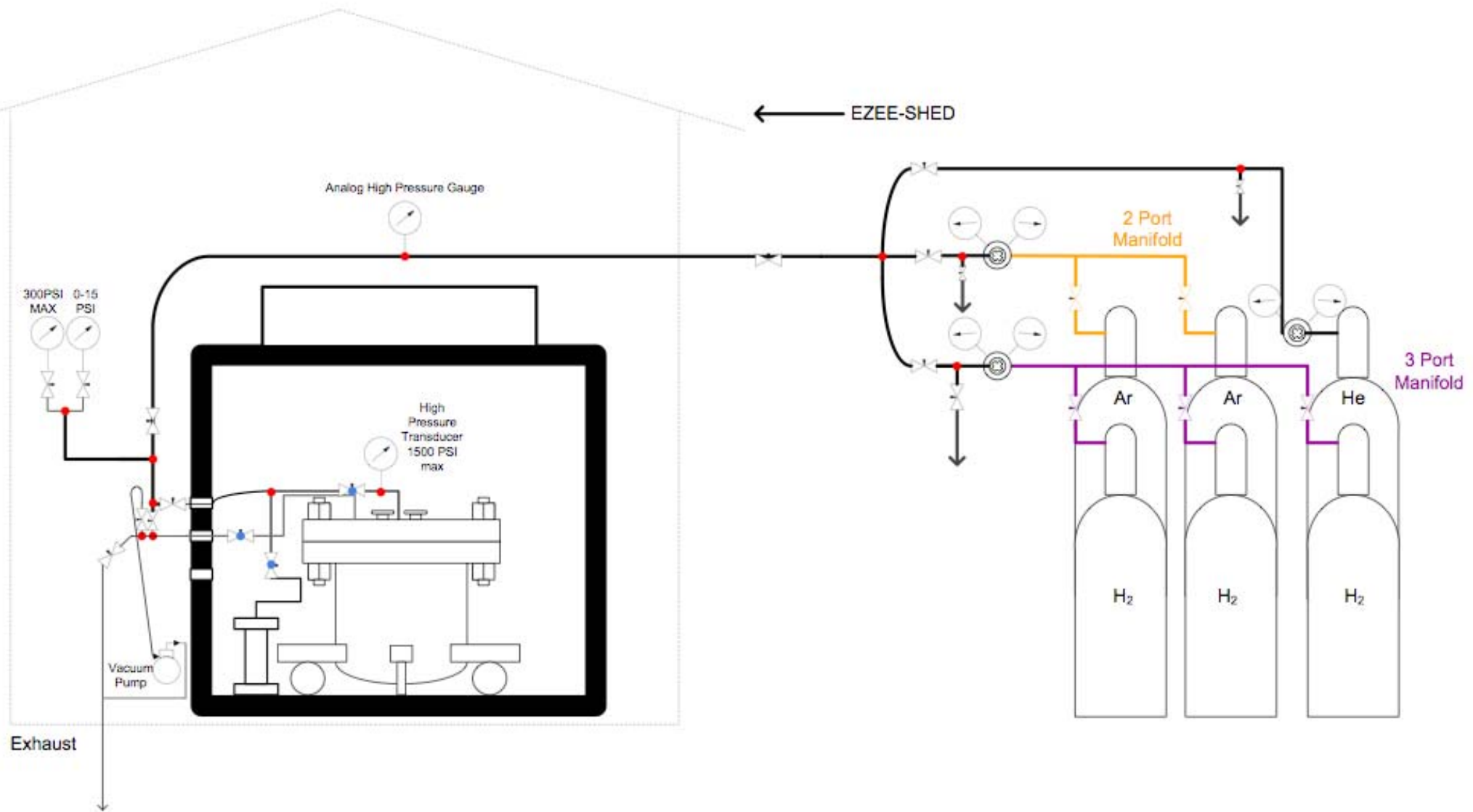
- Our primary objective is to measure H_2O and NH_3 microwave opacity under Deep Jovian conditions for the Juno MWR
- **Jupiter:** Primary microwave absorbing constituents for NH_3 and H_2O in an H_2/He atmosphere
- **Venus:** primary microwave absorbing constituents of interest CO_2/N_2 , possibly Carbonyl Sulfide (OCS/COS) near the surface

Is this a stretch? No, not really.

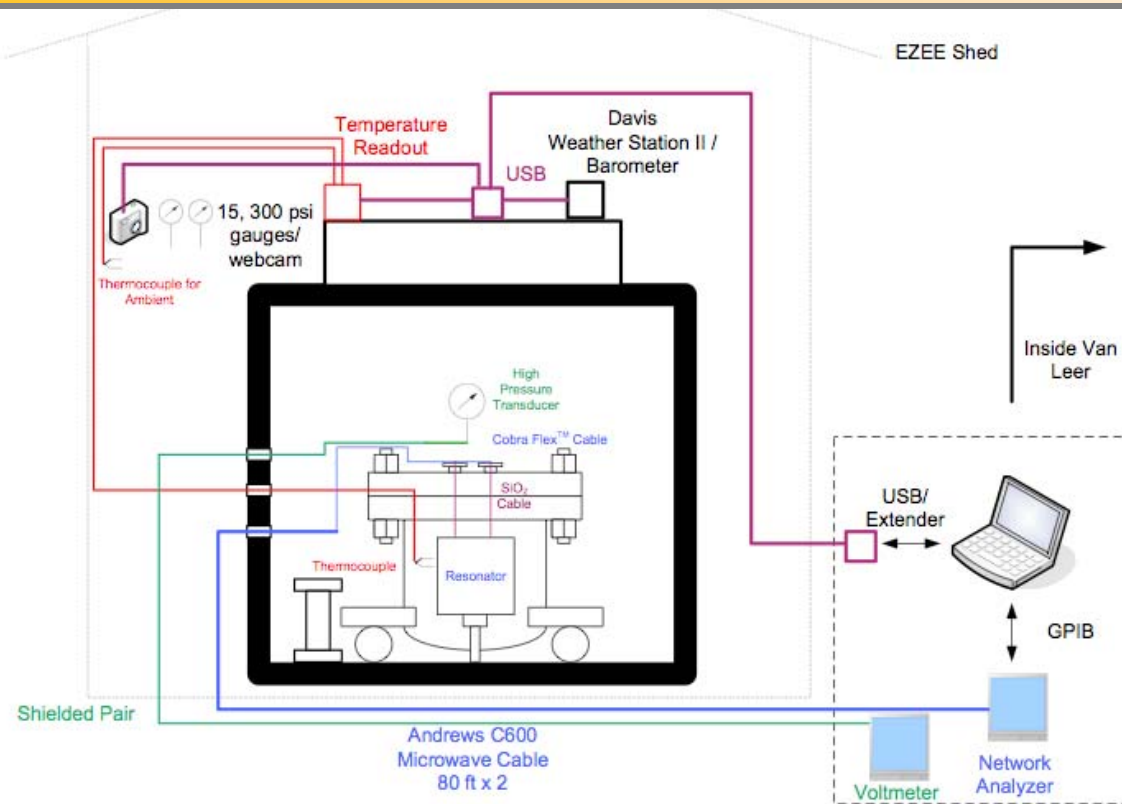


Not if you consider that 1/2 H_2O models under Jovian conditions are in large part based upon measurements made for Venus (Cytherean conditions)

Georgia Tech High Pressure Measurement System (Pressure System)



Georgia Tech High Pressure Measurement System (Data/Microwave System)



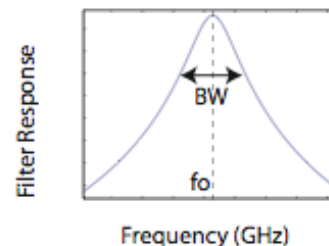
• Measure Quality Factor $Q = \frac{f_o}{BW}$

• Absorption $\alpha = 8.686 \frac{\pi}{\lambda} \left(\frac{1 - \sqrt{t_{loaded}}}{Q_{loaded}^m} - \frac{1 - \sqrt{t_{matched}}}{Q_{matched}^m} \right)$

• Sensitivity of 0.01 dB/km or 0.0023 km⁻¹ (*Hanley and Steffes, 2007*) likely to degrade due to water adsorption

• Improved computer interface to read in temperature and pressure

- Pressure Vessel: 100+ Bars/ 246°C (Hays)
- SMA Feedthroughs 350°C (Ceramtec)
- Oven: 343°C max (Grieve/Ebay)
- Pressure Transducer 343°C 1500 psi max 0.25% accuracy (Omega/Omegadyne)
- SiO₂ 1000°C connector 600°C (Times)
- CobraFlex- 250°C max (Astrolab)



How Did We Get this Up Here?



136 kg (300 lbs)



726 kg (1600 lbs)



544 kg (1200 lbs)

+

=





How Does it all fit together?



How Does it all fit together?



How Does it all fit together?



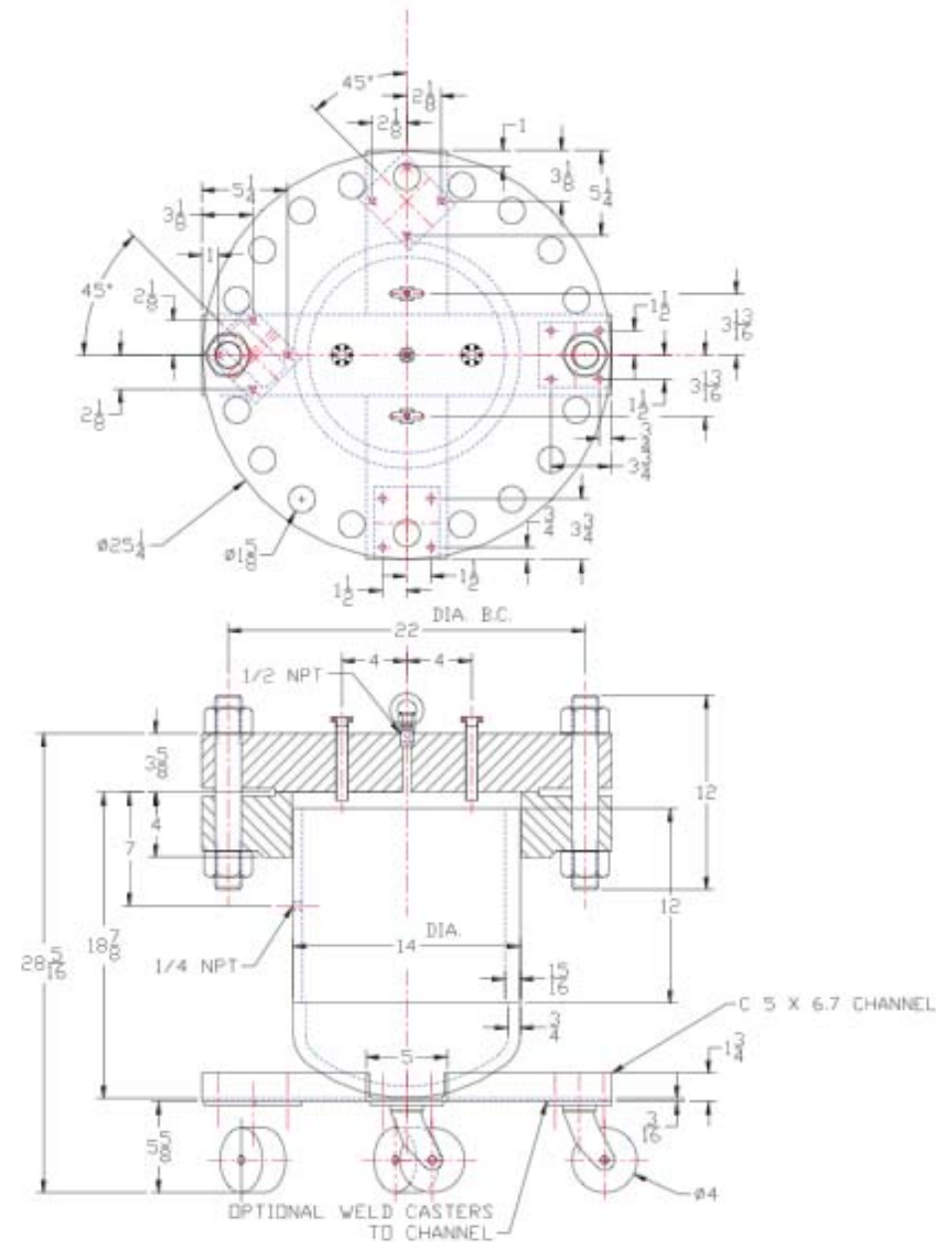
How Does it all fit together?



How Does it all fit together?



How Does it all fit together?

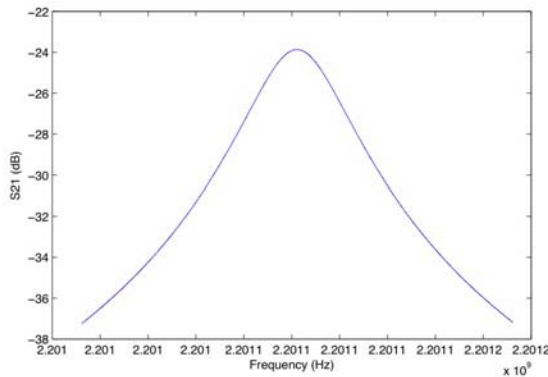


Does it work?



Does it Heat up?

Yes, but we need more
Power to go up to Max
Temperature

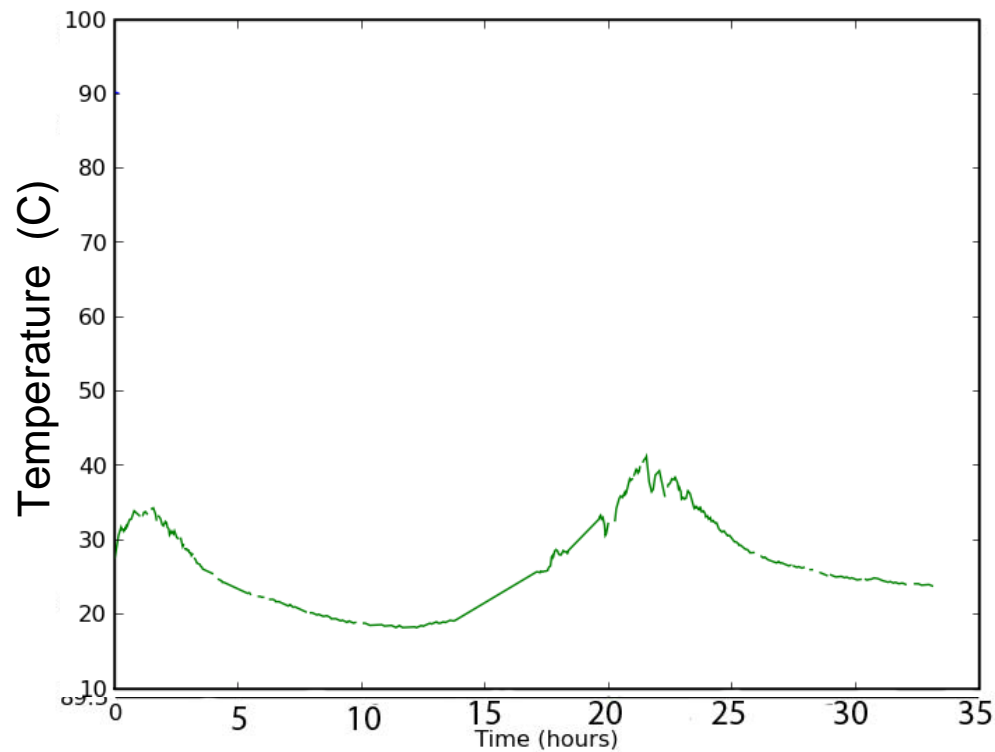


Can we measure Q?

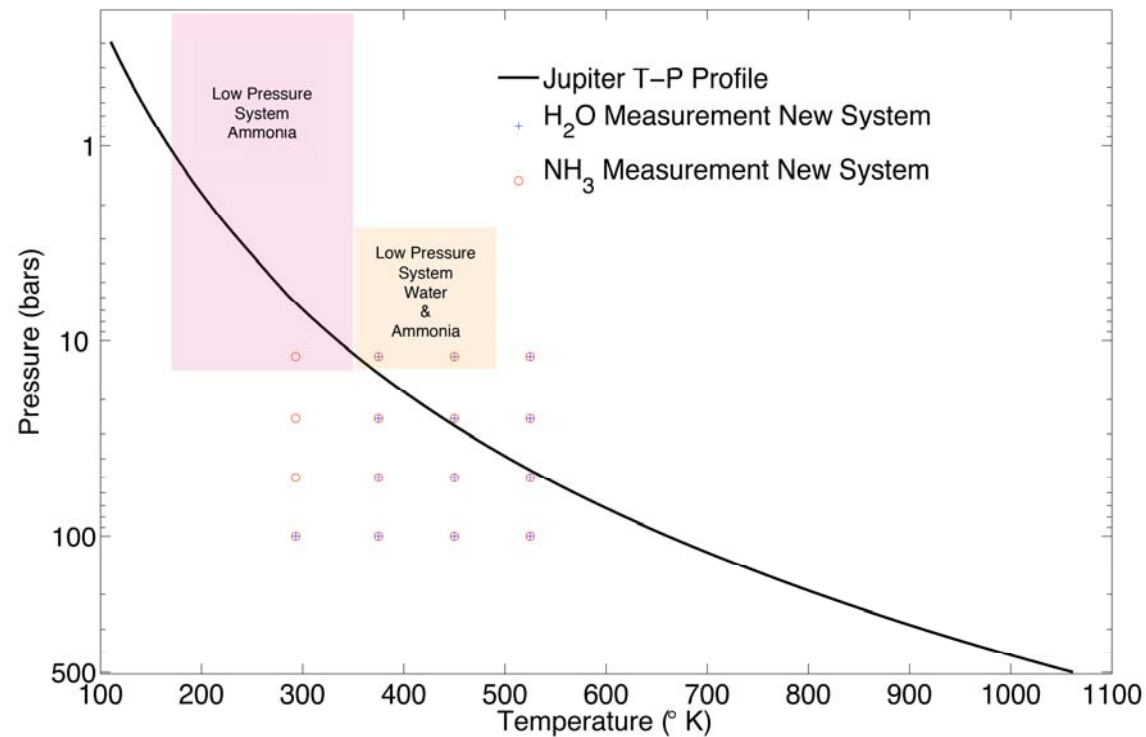
Yes!

Does it work?

Does it hold Pressure?
Yes! Up to 90 bars so far.

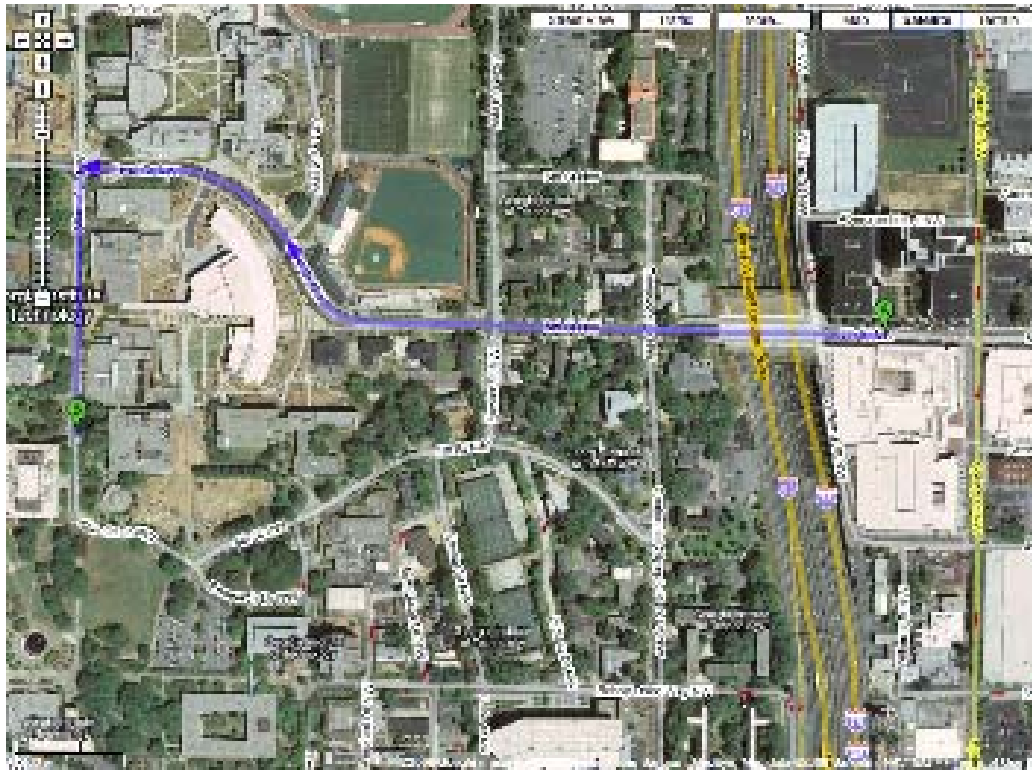


What's Next?



- Start Measuring!
- Add higher current service for oven
- Other improvements
 - Mix our own H₂/He
 - Stair climber for bottle delivery
- Develop new model for H₂O absorption

Questions? / Tour invitation.



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