



**Jet Propulsion Laboratory**  
California Institute of Technology

# University of Illinois Students: Meet JPL

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Instrument Software and Science Data Systems

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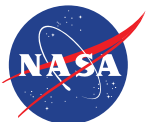
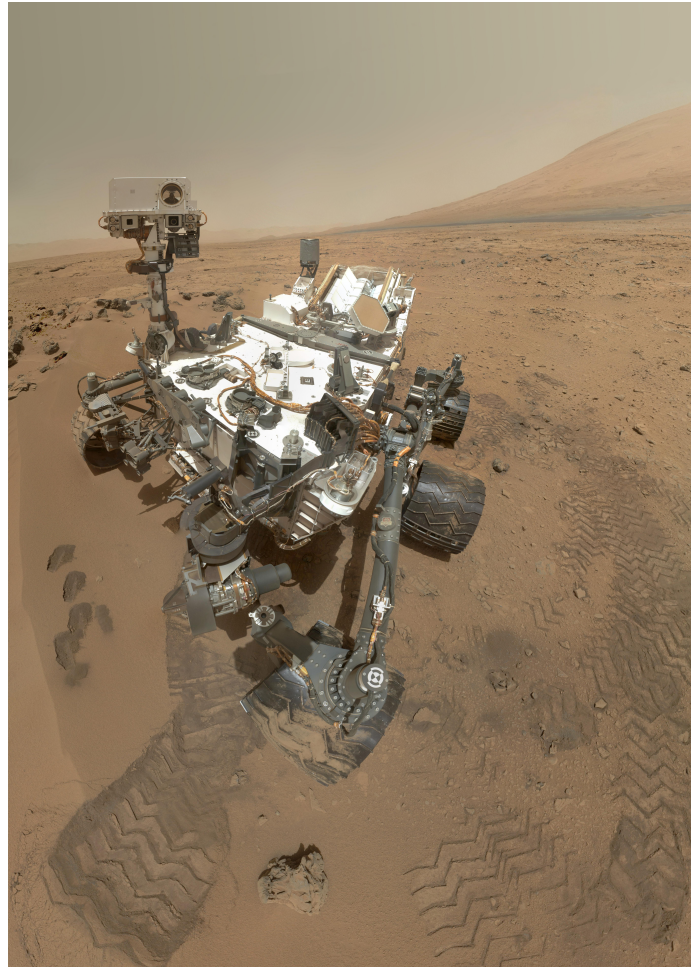
# Welcome to Outer Space

Our family includes ...

- Scientists and Engineers
- Public Education and Writers/Artists
- Accountants/Administration
- Software Programmers and Testers
- Metal Workers, Electricians, Carpenters
- 5,000 people on 177 acres
- Started in mid-1930s by mad rocket scientists (Google JPL history, esp. Frank Malina)



# Get a New Perspective



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[www.jpl.nasa.gov/spaceimages](http://www.jpl.nasa.gov/spaceimages)

# Where are We Now?



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# Working at JPL

- JPL is Federally Funded Research and Development Center (owned by NASA but 100% run by CalTech)
- We solicit work from NASA, DoD, Dept of Energy, even private industry and other National Labs
- Organized broadly by areas such as Science Research, Spacecraft and Instrument Systems, new technology innovations, and also operating NASA's Deep Space Network of tracking stations
- Most people work long hours Monday-Thursday then get every other Friday off – lots of interesting talks every week from leaders of science, industry and culture - *This is a fun and unique place to work*

# My career path to JPL

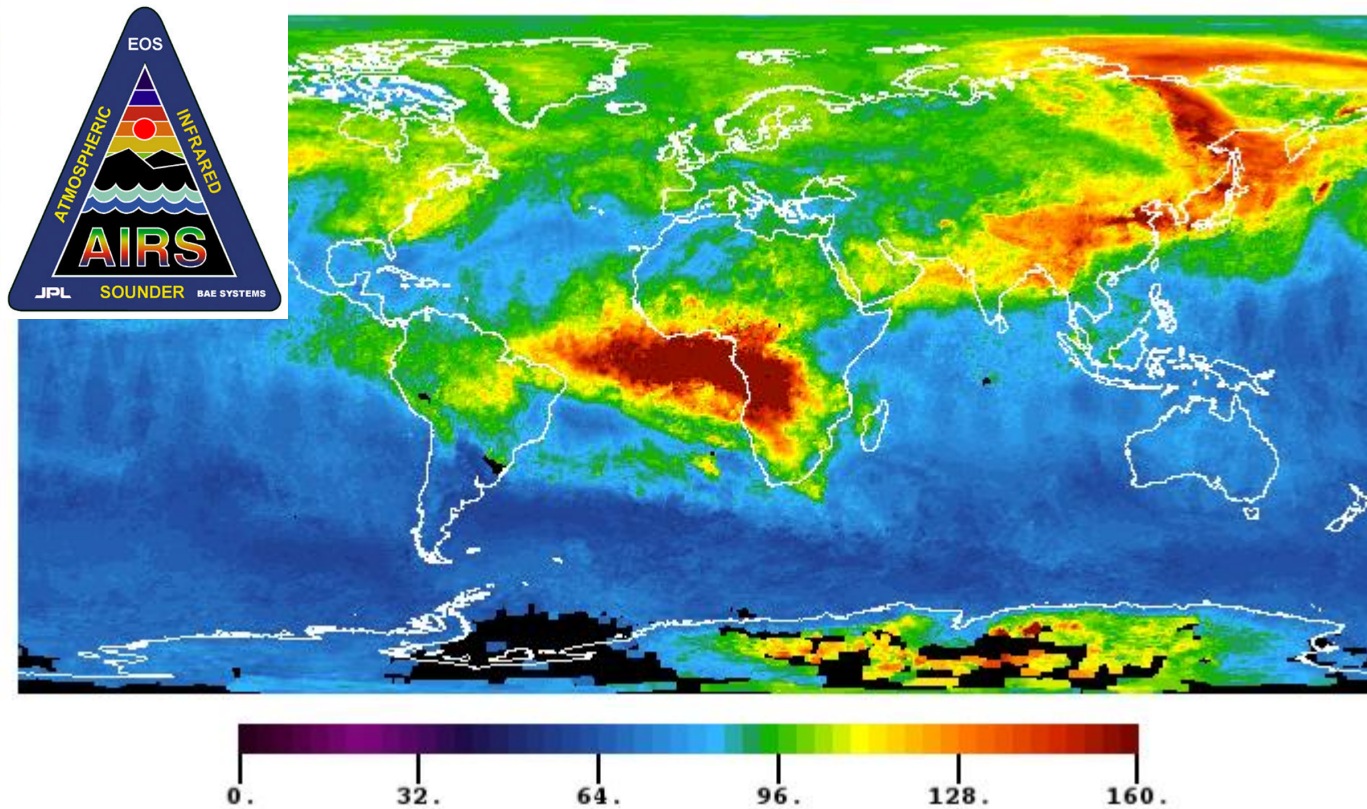
- University Of Illinois: Sigma Phi Epsilon fraternity; President Astronomy Club (1979-1980); NASA Dryden Engineering Coop (1980-1982); President Co-op Society (1982-1983)
- B.S. Aero/Astronautical Engineering (UIUC 1983)
- Sikorsky Aircraft (helicopter flight controls) 1983-1985
- Jet Propulsion Laboratory (1985- Present): Planetary mission design, sequencing, control team; small software engineering projects, then Earth Science since May 1998
- Professional certificates in Application Programming and Teacher of English as Foreign Language (UCLA Extension)
- M.S. Software Engineering (2008) from Cal-State Fullerton
- Many, many JPL-sponsored classes and workshops on best software practices, Software Maturity Model, promoting helpful software development tools and templates

# Atmospheric Infrared Sounder (AIRS)

- AIRS is a hyperspectral infrared spectrometer (2,378 channels) for remote atmospheric sensing on the Earth polar orbit Aqua spacecraft (Launched May 2002). Cost \$225M!
- This technology first tested out with Earth observatories on Jupiter in the 1970s, then as an airborne instrument in the 1980s. Creator: the late Dr. Mustafa Chahine (Former JPL Lab Chief Scientist)
- Infrared light (heat) allows us to measure the atmosphere for water, carbon dioxide, temperature, ozone and other gases
- Our data set is 24 hr/day since Sept 2002 – equivalent to 324,000 weather balloons per day!
- Climate: What you expect to see // Weather: What you actually get
- [www.airs.jpl.nasa.gov](http://www.airs.jpl.nasa.gov)



# Real Science: Carbon Monoxide (ppb) August 2013



# My Evolving Role on the AIRS Project

- Test instrument software and design patches for the main program – all at the machine code level (i.e., uploaded after an imperfect program is loaded and running)
- Support in-flight instrument calibration after launch then develop an automated trending system with web-based reports to monitor instrument hardware health
- Current tasks (very rare for an engineer to do both engineering AND science):
  - CODING: Continuously update program with an atmosphere radiative transfer model (heat moving through the atmosphere) to derive CO<sub>2</sub> levels
  - SCIENCE: Compare our view with weather balloon and aircraft measurements and computer models
  - TESTING: Test out recent changes to the ground software system that builds science data products (free to all researchers and the public), then verify it works just as well at our Earth science data center at NASA Goddard in Maryland
  - OUTREACH: Use various high-level language to get science data into special files/formats useful by the public or other researchers (e.g., climate drought models, severe weather analysis tools or “hot” breaking stories on climate change)

# Some JPL Student Programs

- Summer Undergraduate Research Fellowship (Must be US citizen or permanent resident). 10-week program, includes experience on proposal and grant writing, plus very meaningful actual research work. Task is tied to an existing project and you work directly with a researcher. This program includes an interview and once at JPL there will be occasional dinners and socializing with scientists. Pay = \$6K!

<http://sfp.caltech.edu/programs/surf>

- Traditional JPL Summer Internship – work assignments are defined, then redefined based on a student's skill set. Applicants are selected based on grades, outside interests and the perceived ability to do a variety of tasks (i.e. more than the “job description”). Some return for a second summer – great for grad school. Foreign students might be eligible.

<http://www.jpl.nasa.gov/opportunities/>

- Co-op engineer program – work alternate school semesters (Fall/Spring/Summer) for the last 2-3 years of undergraduate school
- Early Career Hires (<5 years since BS/MS degree)
- Post-Doctoral Positions – Research for new PhDs – usually funded by an organization outside JPL (e.g., UCLA, NASA, NOAA)



# What JPL is seeking (from you)

- Curiosity about science, engineering and problem-solving
- Cultural, socio-economic and gender diversity
- Good people skills – speak well, write clearly, know how to ask questions and ask for help
- Be familiar with basics of math and science. Good grades are no guarantee but poor grades will close doors to you.
- At least one language (Python, Matlab, C)

# Resources

- Book: “Advice to Rocket Scientists: A Career Survival Guide for Scientists and Engineers” by former JPLer/Purdue Prof. Jim Longuski – a valuable (very humorous) must for undergrads
- Book: “Astro Turf: The Private Life of Rocket Science” by M. G. Lord – fascinating look at JPL at its birth, in the 1960s and today
- Contact JPL people about their papers, their research and challenges – you will learn a lot and also get noticed if you are sincere.
- Attend conferences and network!

# More insights

- Your astronomy, physics and computer science professors probably know some JPLers already! – ask them about their own interactions
- This past week I discussed internship possibilities with our astrophysicists working on the Dark Energy Survey, Large Synoptic Sky Survey, etc.
- Contact me about your aspirations [[Stephen.J.Licata@jpl.nasa.gov](mailto:Stephen.J.Licata@jpl.nasa.gov)] to ensure your application gets seen by a wider set of hiring managers (the internship office is overwhelmed with applicants)
- Time spent now will pay many career dividends if you look beyond just college
- Remember: After you graduate no one will care where you went to school – only what you can contribute on the job



# Time for Questions!



(Thank you, deer audience)