Working at NASA
A Brief Summary

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Background

- My experience is as an electronics engineer for NASA spaceflight and airborne applications since 2002.
  - Proposals, concepts, development, operations
  - My favorite work is on scientific instruments
- Non-traditional education & career path
  - BSEE 2000 (Virginia Tech)
  - Constant continuing education (graduate courses, certificate, training classes, conferences)
  - Set highest priority on hands-on, high-reliability projects with several groups within NASA

Background

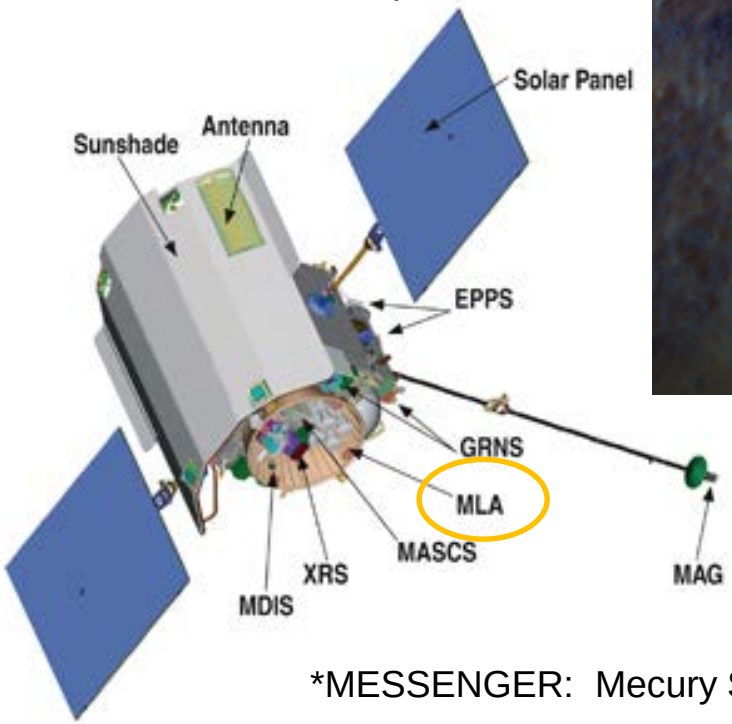
- What does my day look like?
  - I work on a base built in the 1950s
    - “Collegiate” atmosphere
    - Lots of trees
    - Old buildings & facilities
  - I average 40-45 hrs/wk, with peaks to ~55-60 hrs/wk
  - I make as much time for design as possible, but typically get about 40-60%
  - Team work - small & large, which requires emails, phone calls, & meetings to varying degrees
  - Mentoring & consulting for others’ projects
  - Lab & field work is about 10%
  - Project cycle goes in phases which vary considerably (computer vs. lab, clean room, etc.)

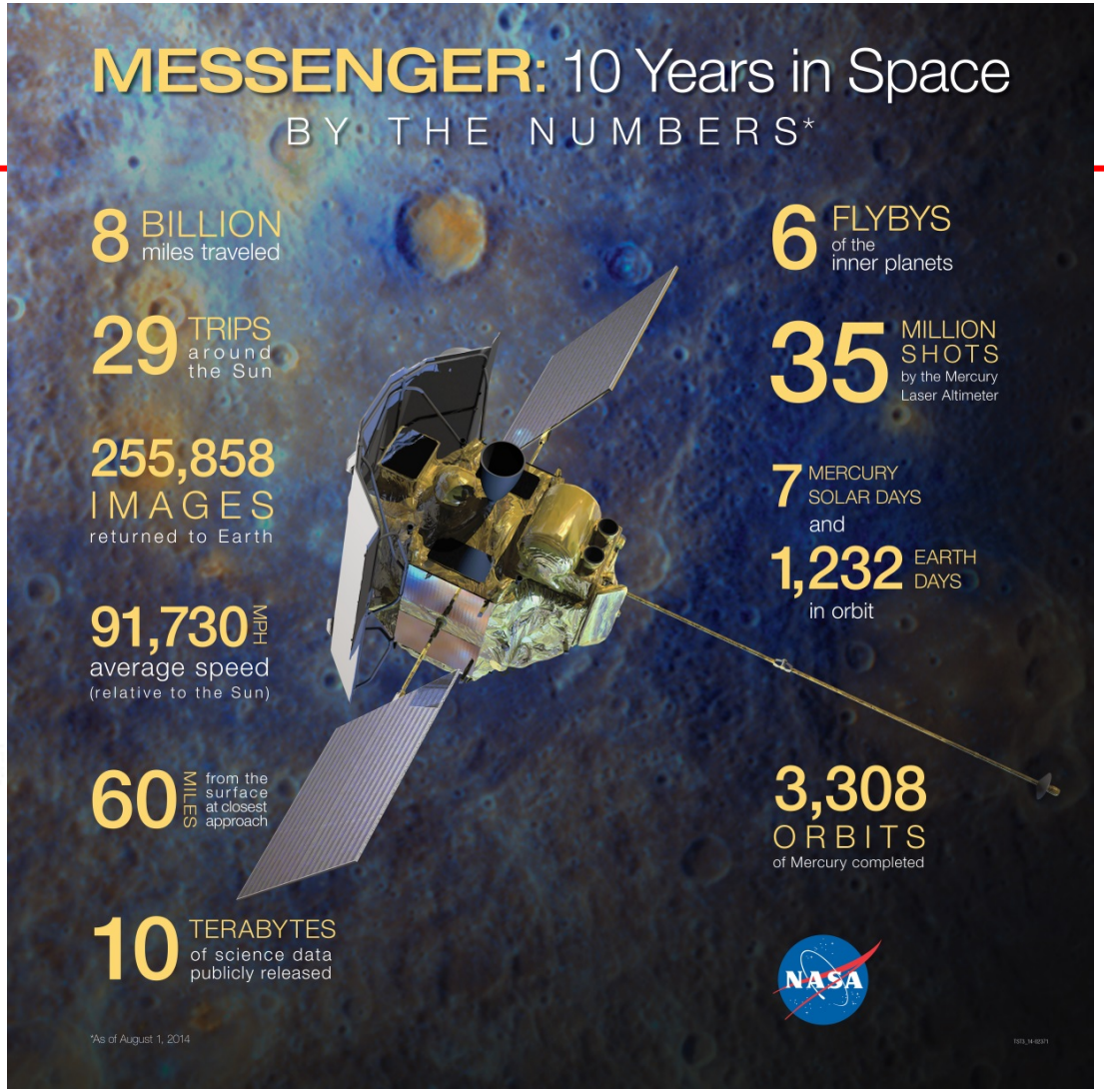
Example Projects

Mercury Laser Altimeter (MLA)

- Instrument onboard the MESSENGER* spacecraft (2004)
- Topographical map of Mercury's surface – fire a laser at the surface, measure the time to reflect back
- Identified water ice in polar regions of Mercury (2012)

MESSENGER Spacecraft



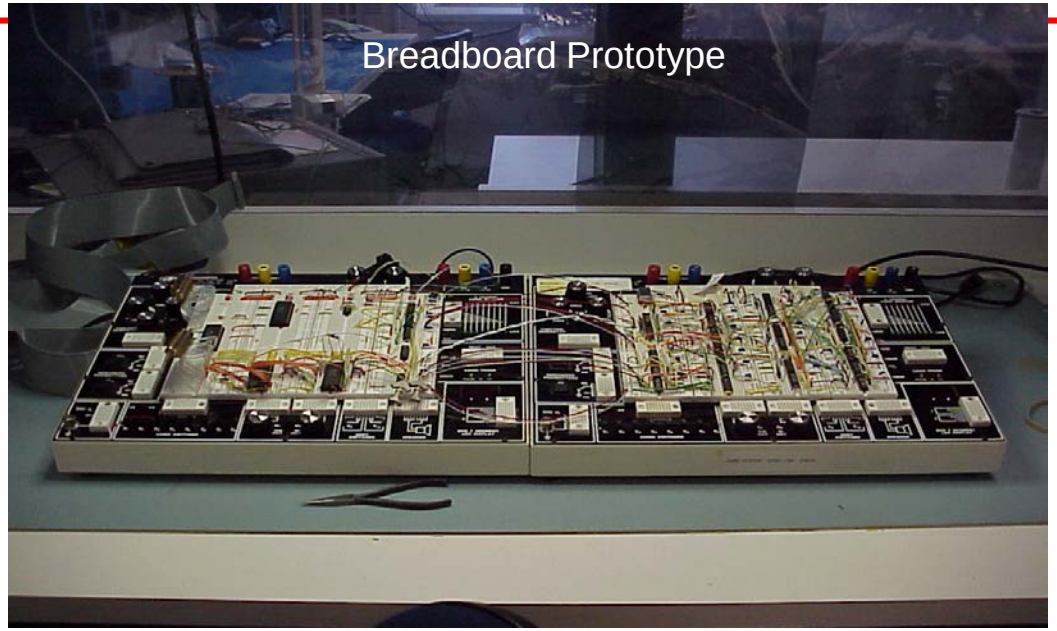


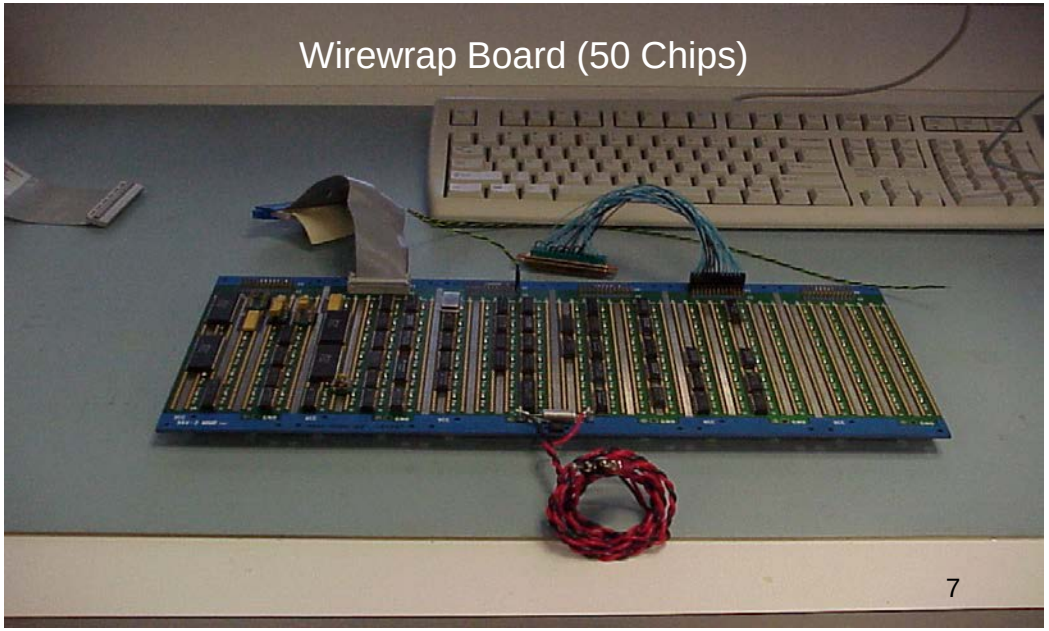
http://www.nasa.gov/mission_pages/messenger/main/index.html
http://messenger.jhuapl.edu/

*MESSENGER: Mecury Surface, Space Environment, Geochemistry, and Ranging

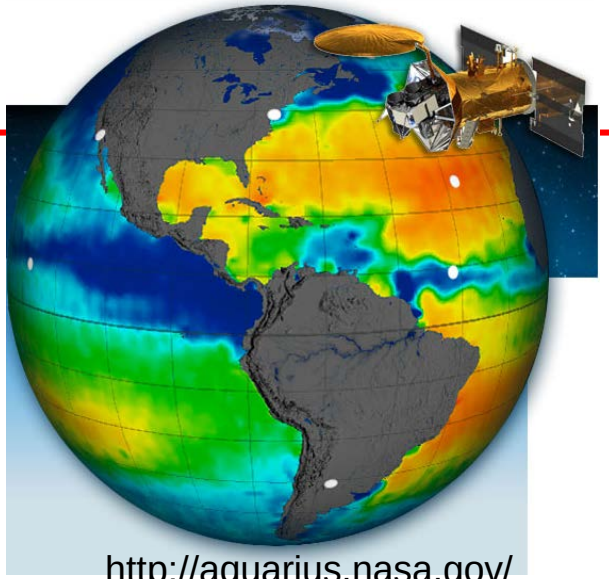
MLA EGSE (2002)

- EGSE = Electrical Ground Support Equipment = custom test gear
- Used to test individual circuit boards on MLA
- My first professional project
  - First exposure to construction methods (breadboard, wirewrap)
  - This is now obsolete – can easily do this w/ one 10mm^2 chip
- In spaceflight, testing is most successful from the ground up:
  - Build any EGSE & test it
  - Test flight hardware w/ EGSE
  - Integrate flight hardware into an instrument
  - Test the instrument
  - Integrate & Test (I&T) of the instrument with the spacecraft
  - Test the spacecraft



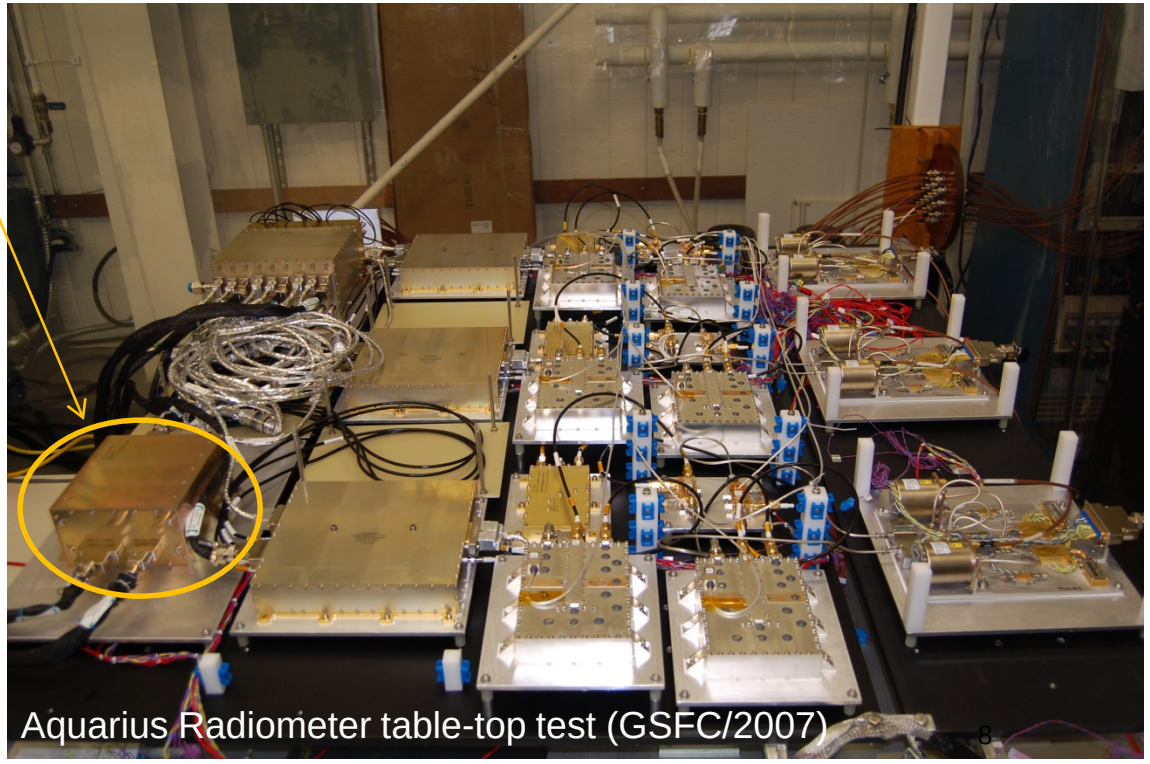


Aquarius/SAC-D Radiometer (2004-2007)



http://aquarius.nasa.gov/

- Aquarius made the first global measurements of Sea Surface Salinity (SSS)
  - SSS is critical parameter in the water cycle
  - Prior measurements were discrete (buoys)
  - Produces one map every TBD
- 1.4 GHz (L-Band) Radiometer measures salinity (remote sensing)
- The Digital Processing Unit (DPU) controls & reads all the radiometer data
- I was lead engineer for the DPU, meaning:
  - Overall conceptual design
  - Circuit design of 2 boards
  - Lead a small group of engineers
  - Lots of meetings, emails, phone calls
- Aquarius launched in 2011, still operating



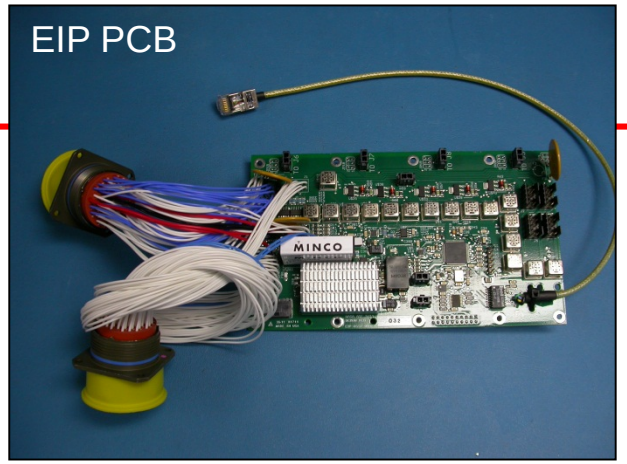
Aquarius Radiometer table-top test (GSFC/2007)

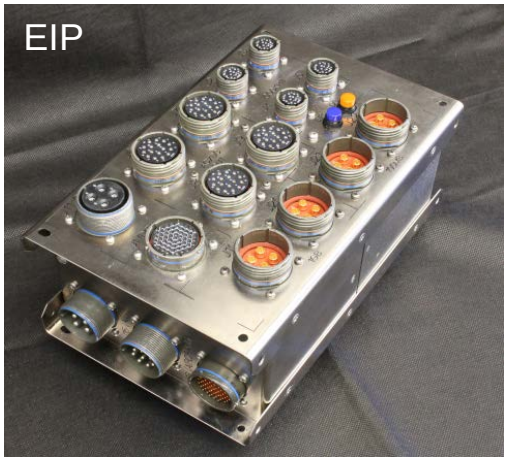
Airborne Science Sensor Web Network (2007-2012)

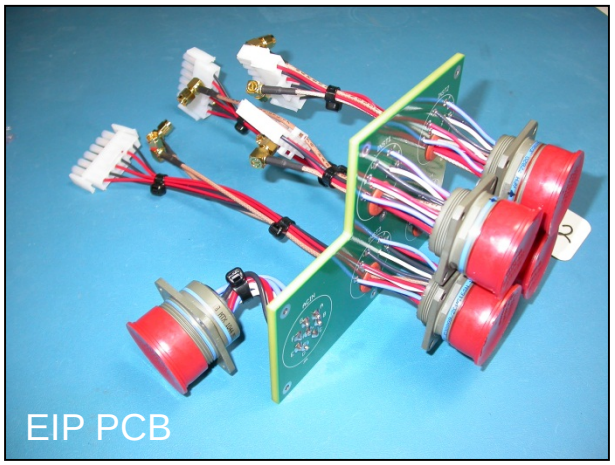
- NASA owns numerous aircraft used to:
  - Calibrate satellite instruments
  - Perform earth science
  - Disaster relief (wildfire monitoring, etc.)
  - Develop new technologies
- Standard interfaces for payloads:
  - Many planes, instruments, combinations
  - Existing standards were old / obsolete
  - Desire for Sensor Webs (discuss)
- My roles:
  - Lead for Experimenter Interface Panel (EIP)
  - Electronics design for other boxes in system (MPCS, NASDAT)

https://airbornescience.nasa.gov/

MPCS

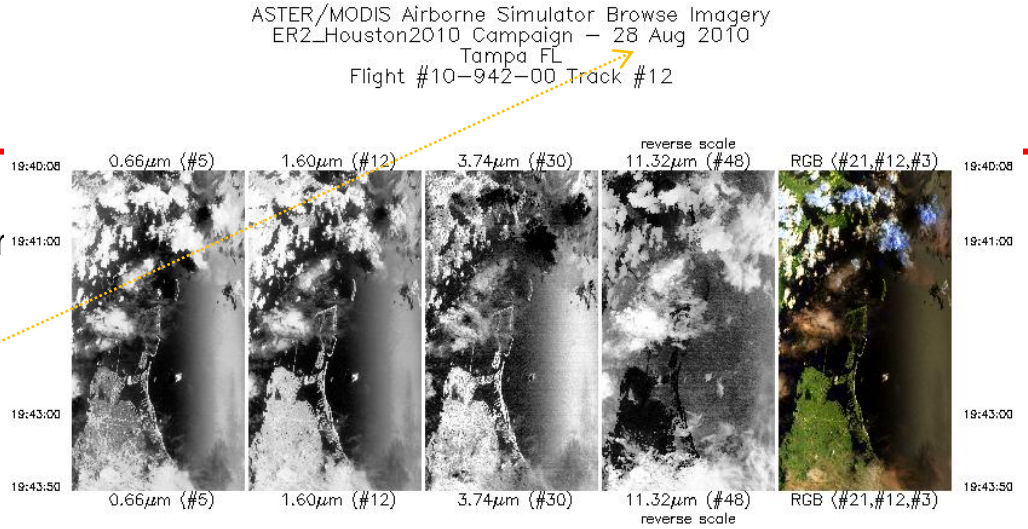


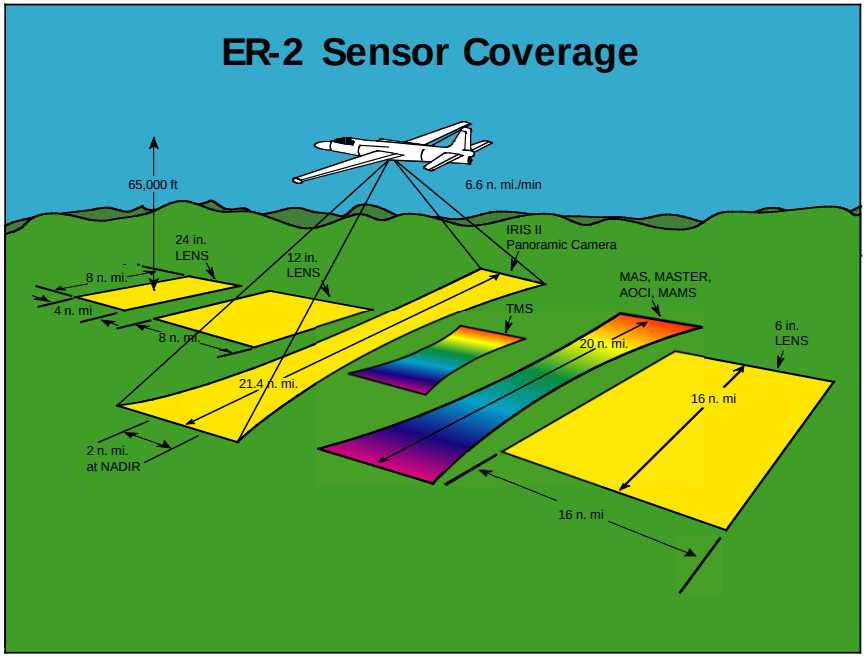


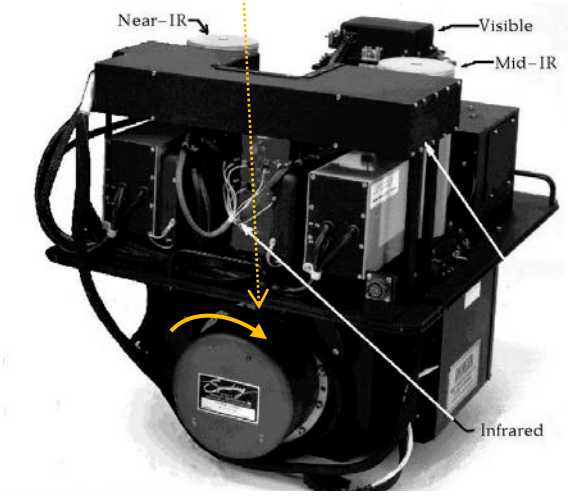


MAS & MASTER (2009-present)

- MODIS and MODIS/ASTER are Airborne Science instruments, used for
  - Calibration of MODIS & ASTER instruments on the Aqua & Terra satellites
  - Ocean color imaging
  - Disaster monitoring
- Whisk-broom spectrometers
  - Airplane flies in a flight track
  - Scan motor 'sweeps' a scan line
  - One flight tracks' worth of scan lines
  - 35-50 spectral bands are simultaneously sampled, allowing overlay of multiple physical phenomena
- My role: analog electronics design



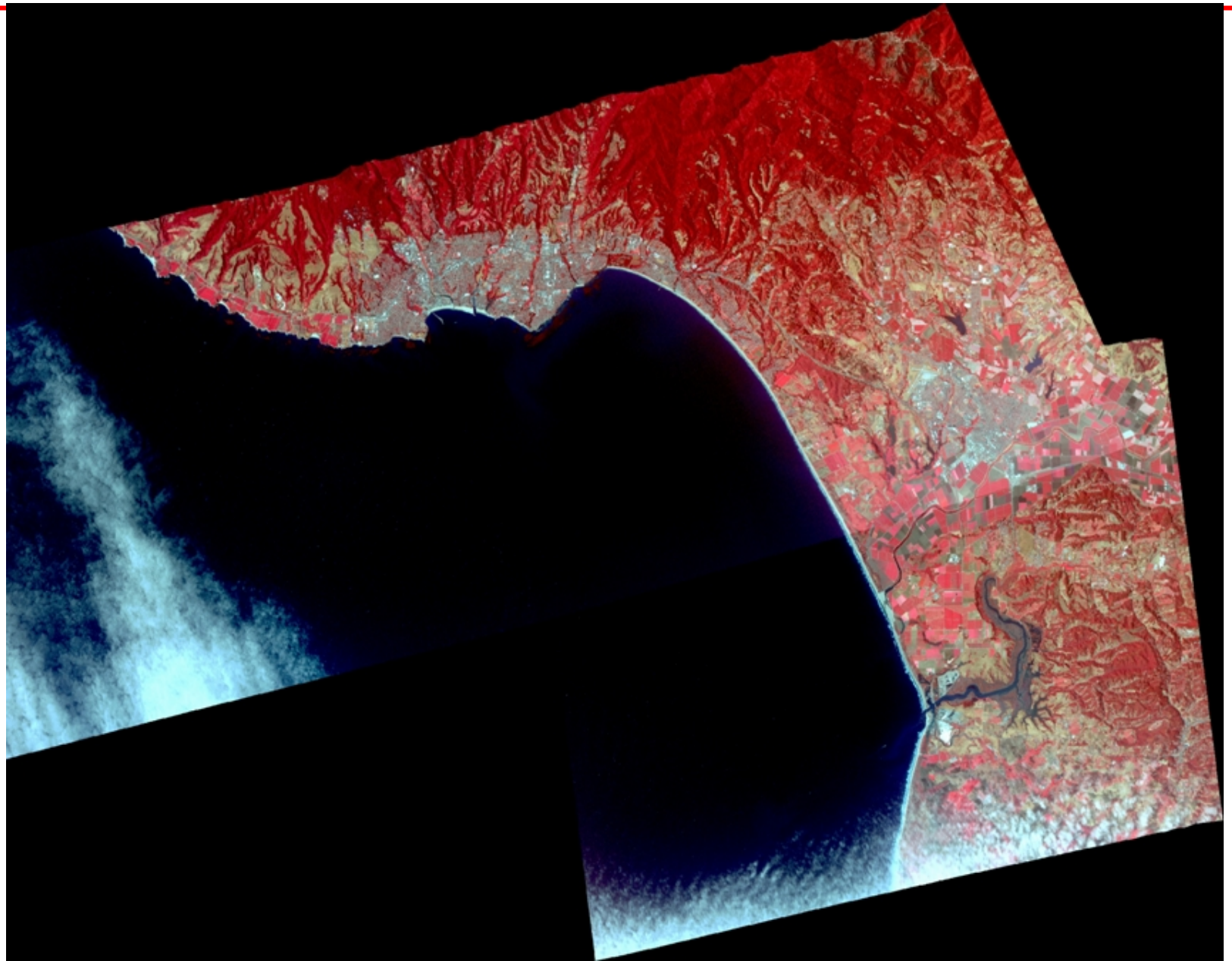




MODIS Airborne Simulator

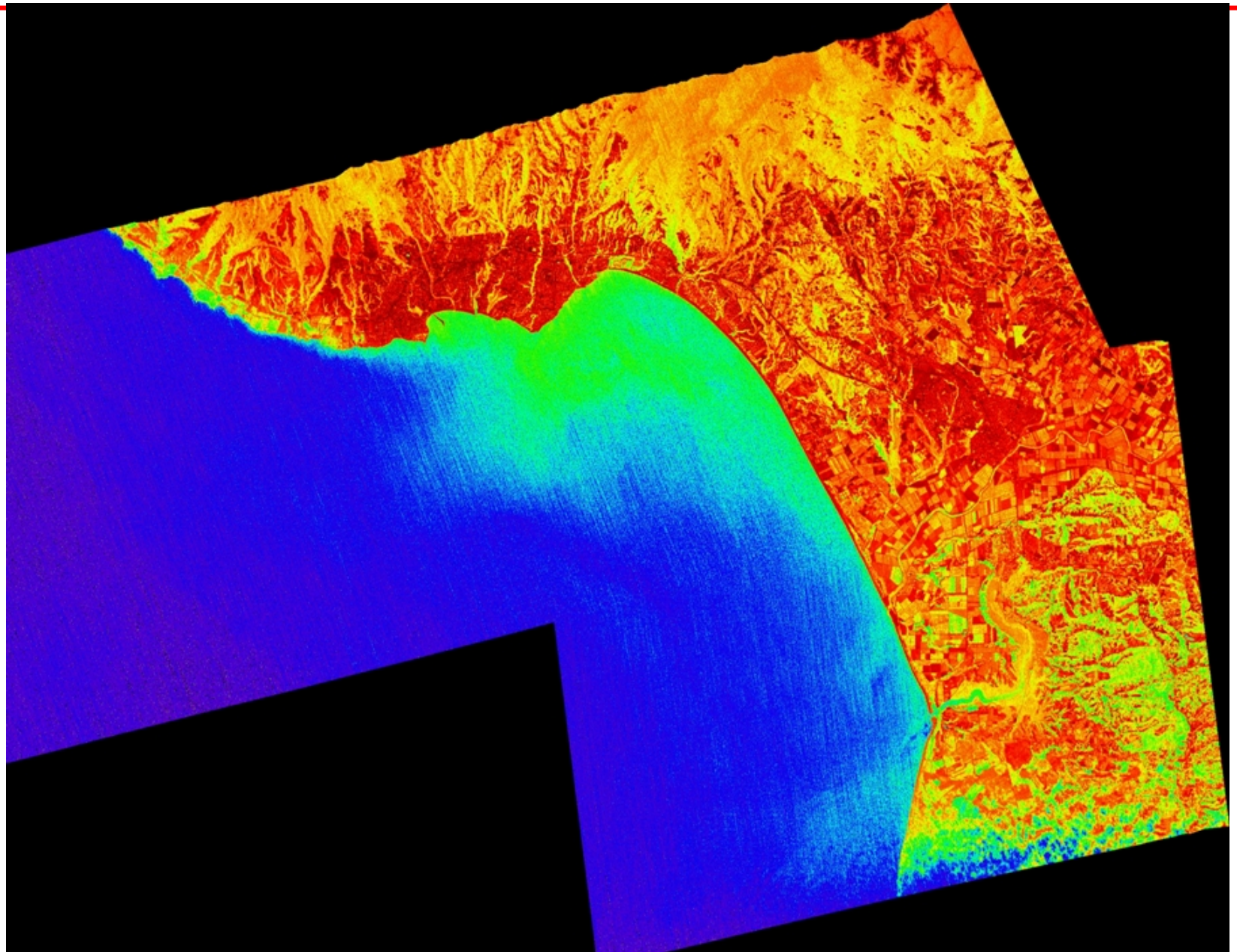
http://mas.arc.nasa.gov/
http://masterweb.jpl.nasa.gov/

SARP 2010 (Monterey Bay Mosaic)
Color Infrared



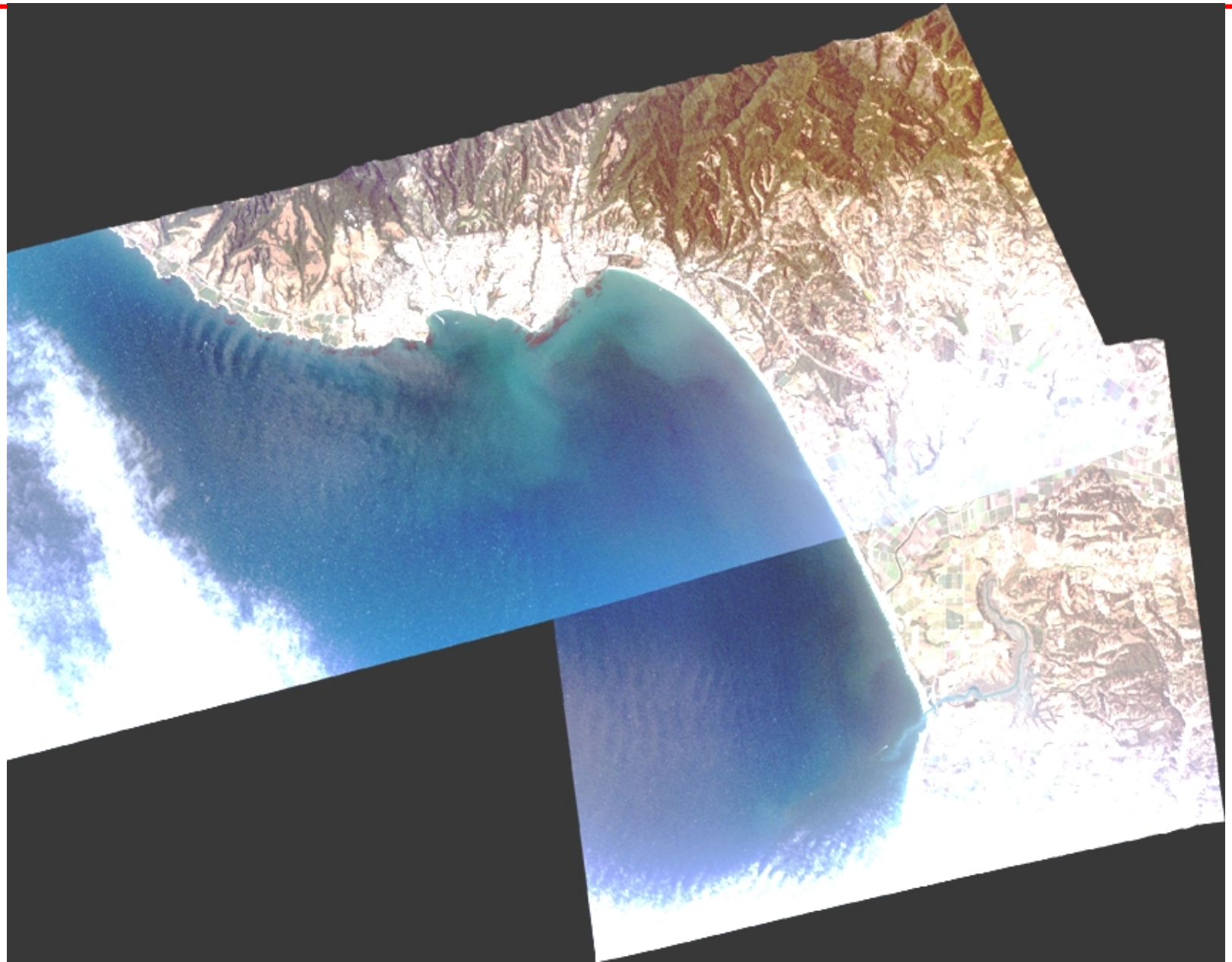
SARP 2010 (Monterey Bay Mosaic)

Thermal Infrared SST



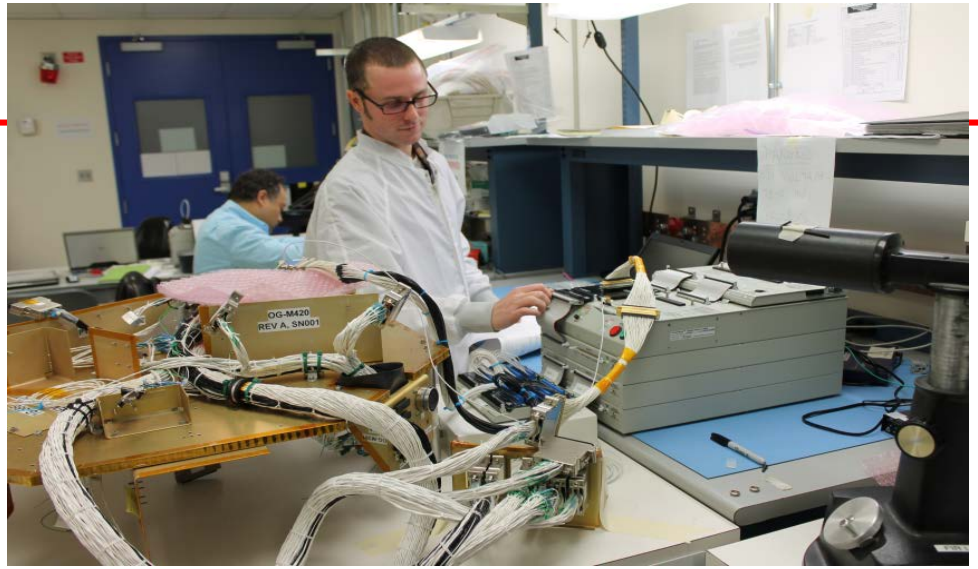
SARP 2010 (Monterey Bay Mosaic)

Natural Color



LADEE (2011-2014)

- Lunar Atmospheric and Dust Environment Explorer (LADEE) was:
  - A high-risk (Class D), short-duration mission
  - Launched 9/6/2013
  - Impacted 4/21/2014
- Science:
  - Measure lunar dust environment observed during Apollo era
  - Technology demonstration of laser communications system (MIT)
- My Role: Power System Engineer
  - Testing of the spacecraft wiring harness
  - Led EMI/EMC* Test
  - Developed Photovoltaic Array Test
  - Power System lead for Mission Operations
  - Power systems engineering is very multidisciplinary



http://www.nasa.gov/mission_pages/ladee/main/

LADEE Photovoltaic Testing
(IEEE Aerospace Presentation)

Thank you for your time & attention.

I hope you enjoy this LADEE Solar Array Installation Video

Questions?

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