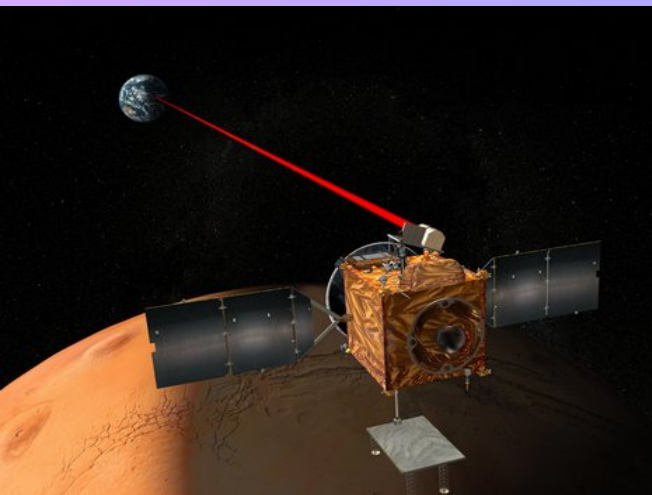


Assessing Laser Lifetime Test Performance



Credit: NASA

Presentation
by
Joe Weichman



Credit: JAXA

BACKGROUND

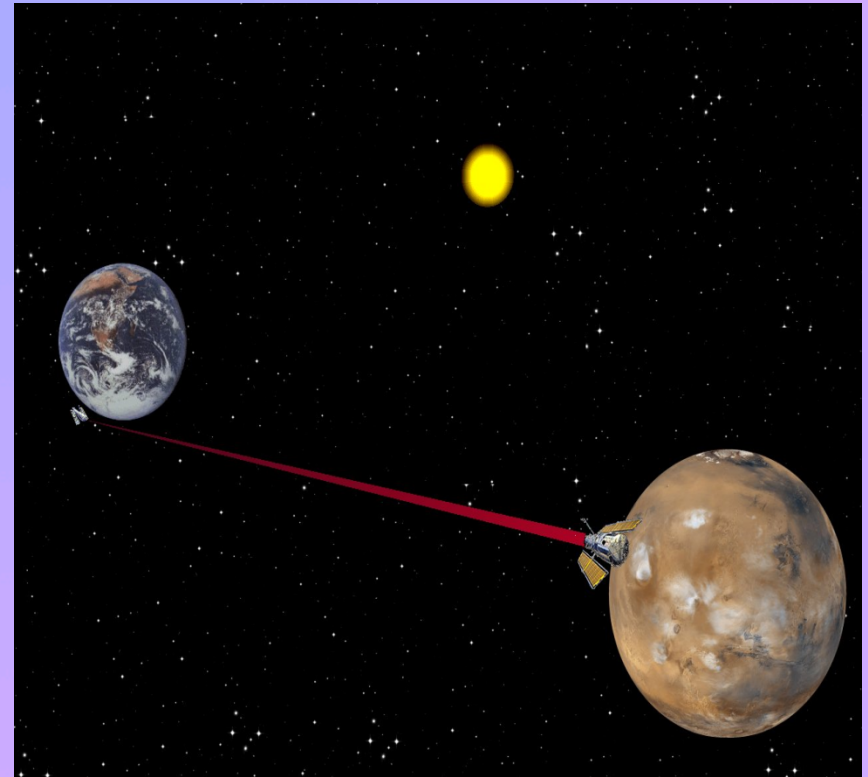
- Pursuing Single Subject Teaching Credential: **Geosciences** – Authorizes Astronomy Teaching
- Starting M.S. in Space Education (Embry Riddle)
- Scheduled to Start Student Teaching in Winter or Spring
- Currently Work at Center for Applied Competitive Technologies (El Camino College)



CSU – Los Angeles (Credit: CSULA)

WHAT IS LASER COMMUNICATIONS?

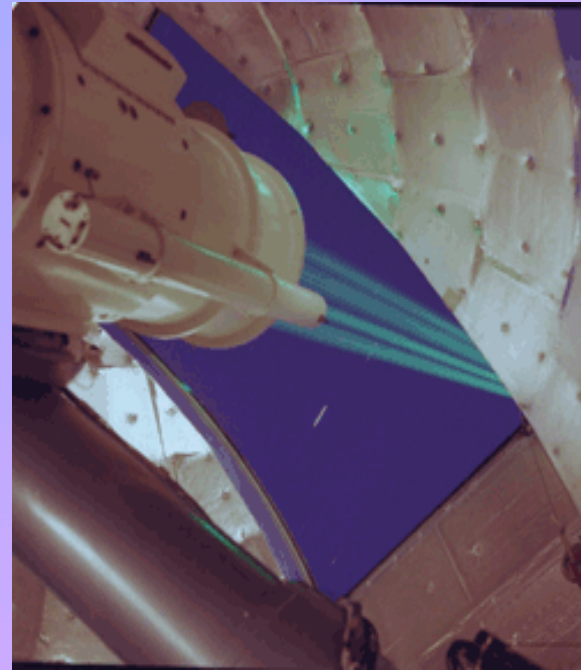
- Using Lasers to Transfer Data
- The Future of Space Communications



Credit: NASA

HOW DOES LASER COMMUNICATIONS WORK?

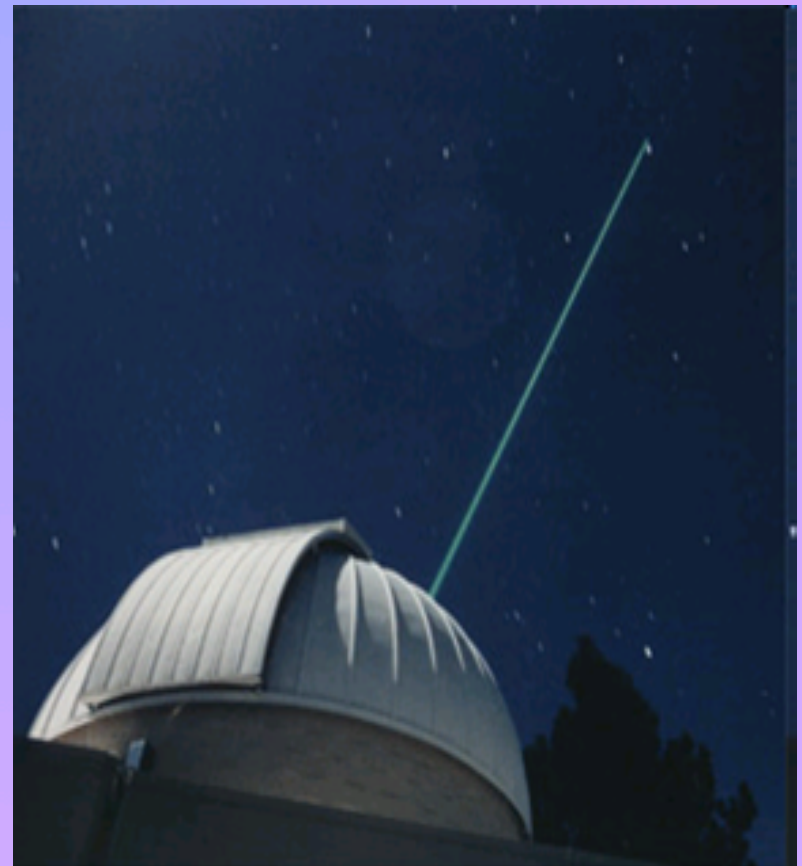
- Message Encoded Into an Optical Signal
- Message Transmitted via Laser
- Receiver Captures Laser and Reproduces Message



Credit: NASA

ADVANTAGES OF LASER COMMUNICATIONS

- High Data Transfer Rates
- Greater Distance
- Reduced Payload Weight & Size
- Reduced Power Consumption
- More Secure



Credit: NASA

THE RANGE OF LASER COMMUNICATIONS

- **On Earth**
 - Ground to Air
 - Air to Ground
- **Outside Earth**
 - Ground to LEO/GEO
 - LEO/GEO to Ground
 - ISS to Ground
 - Ground to ISS
- **Solar System**
 - Planet to Planet
 - Planets Outside Solar System



Credit: RUAG Space

PROJECT TASK

Conduct laser lifetime test to assess maximum performance capability and overall functionality over a given timeframe.



Credit: NASA

TASK RELEVANCE

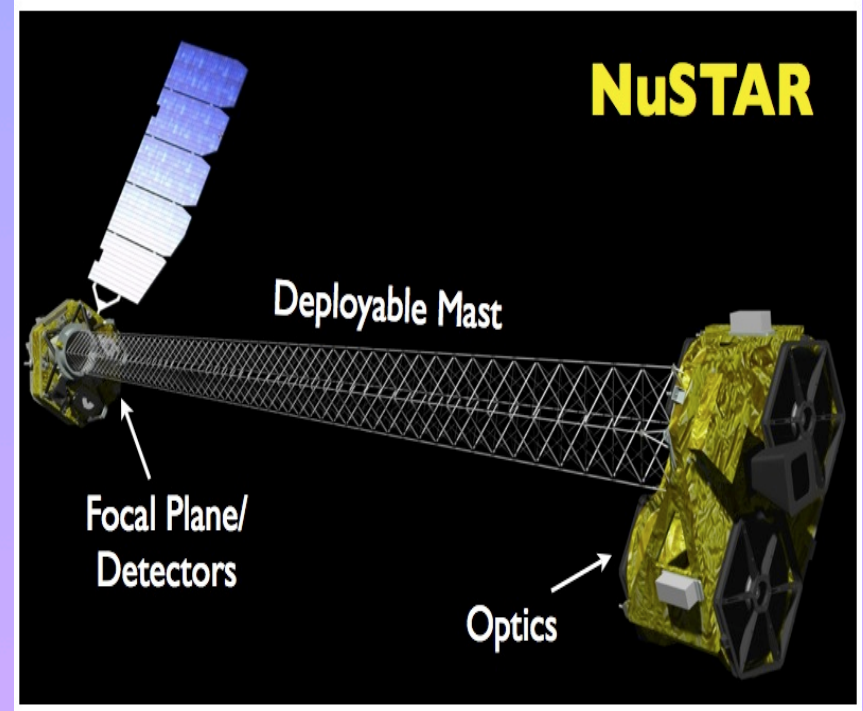
- Performing any task in space is problematic:
 - Safety
 - Vacuum
 - Radiation
 - Cost (Hubble Fix - \$500 Million)
 - Difficulty
 - Maneuvering Capability
 - Zero Gravity Environment
 - Time Constraints
 - Distance (JWST)
- Knowing laser life in space environment can minimize potential issues that would require in-space fixes or abandonment of project.



Credit: NASA

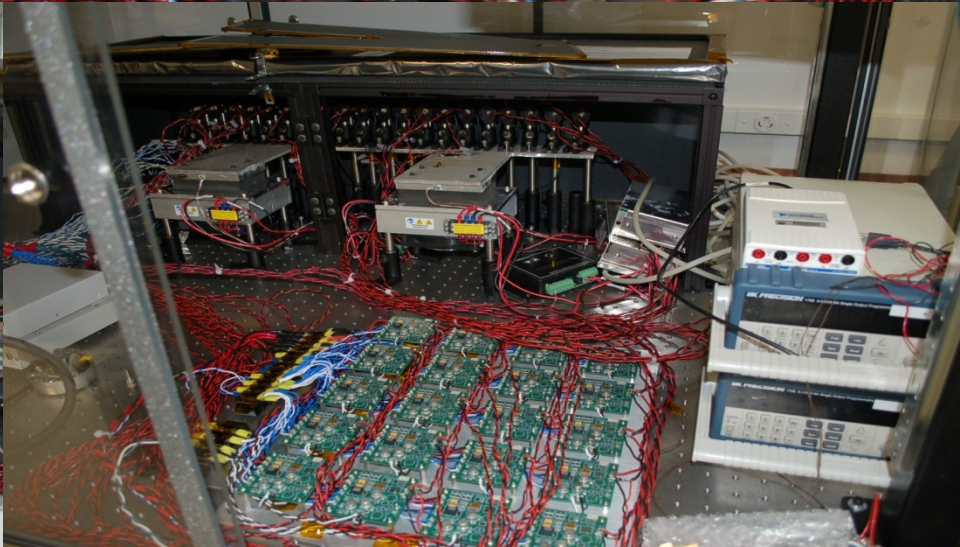
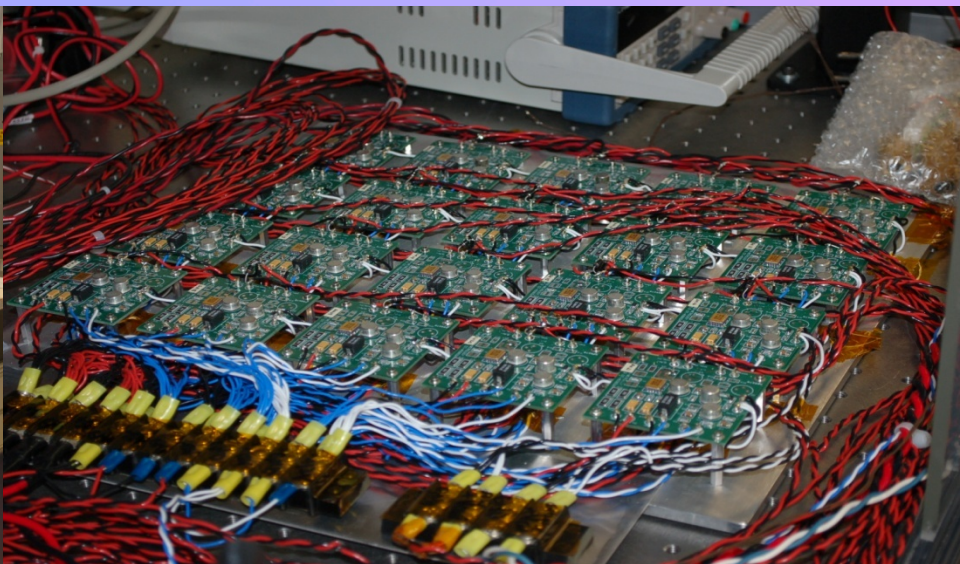
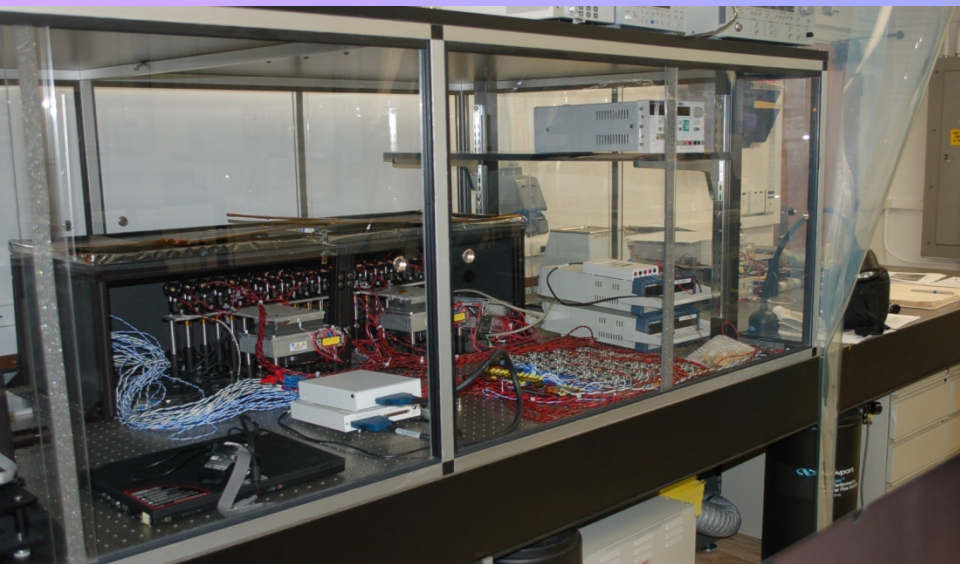
BACKGROUND

- NuSTAR is a future X-ray space telescope.
- Lasers used for NuSTAR metrology system to correct X-ray images that would otherwise be blurred from the mast motion.
- Lasers were tested for duration of mission life (six months).
- Now looking to determine what overall lifetime is.



Credit: NASA

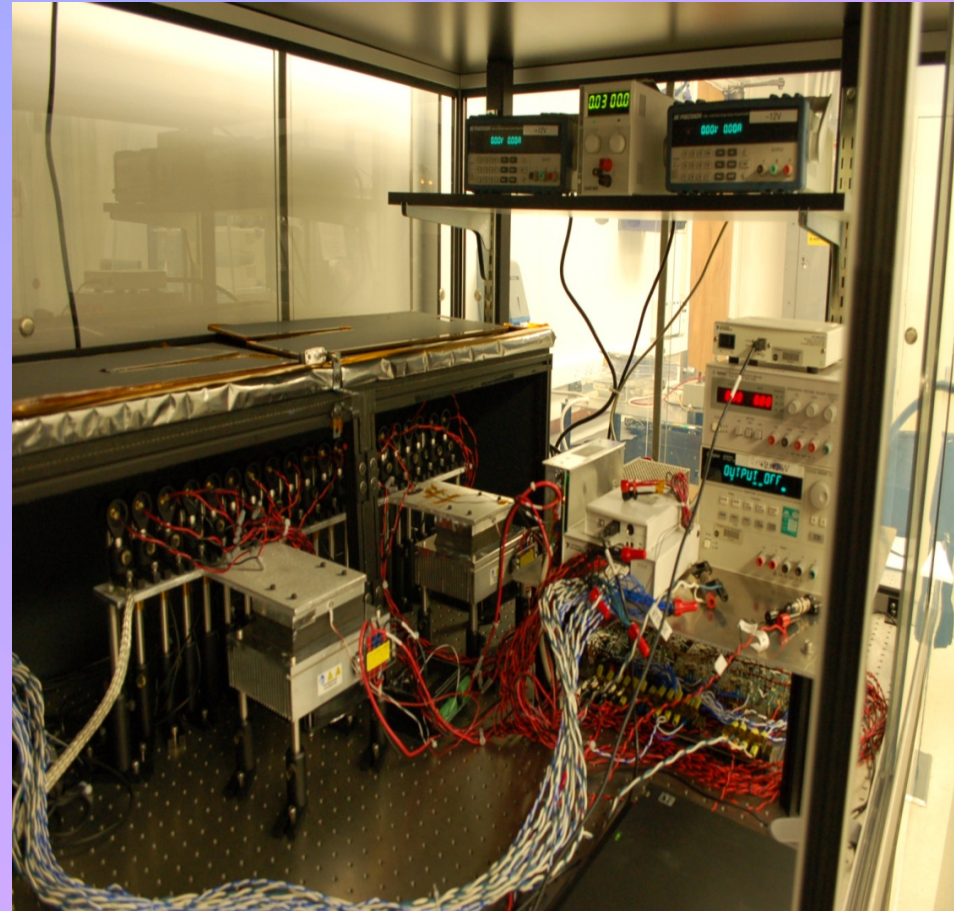
DELIVERED COMPONENTS



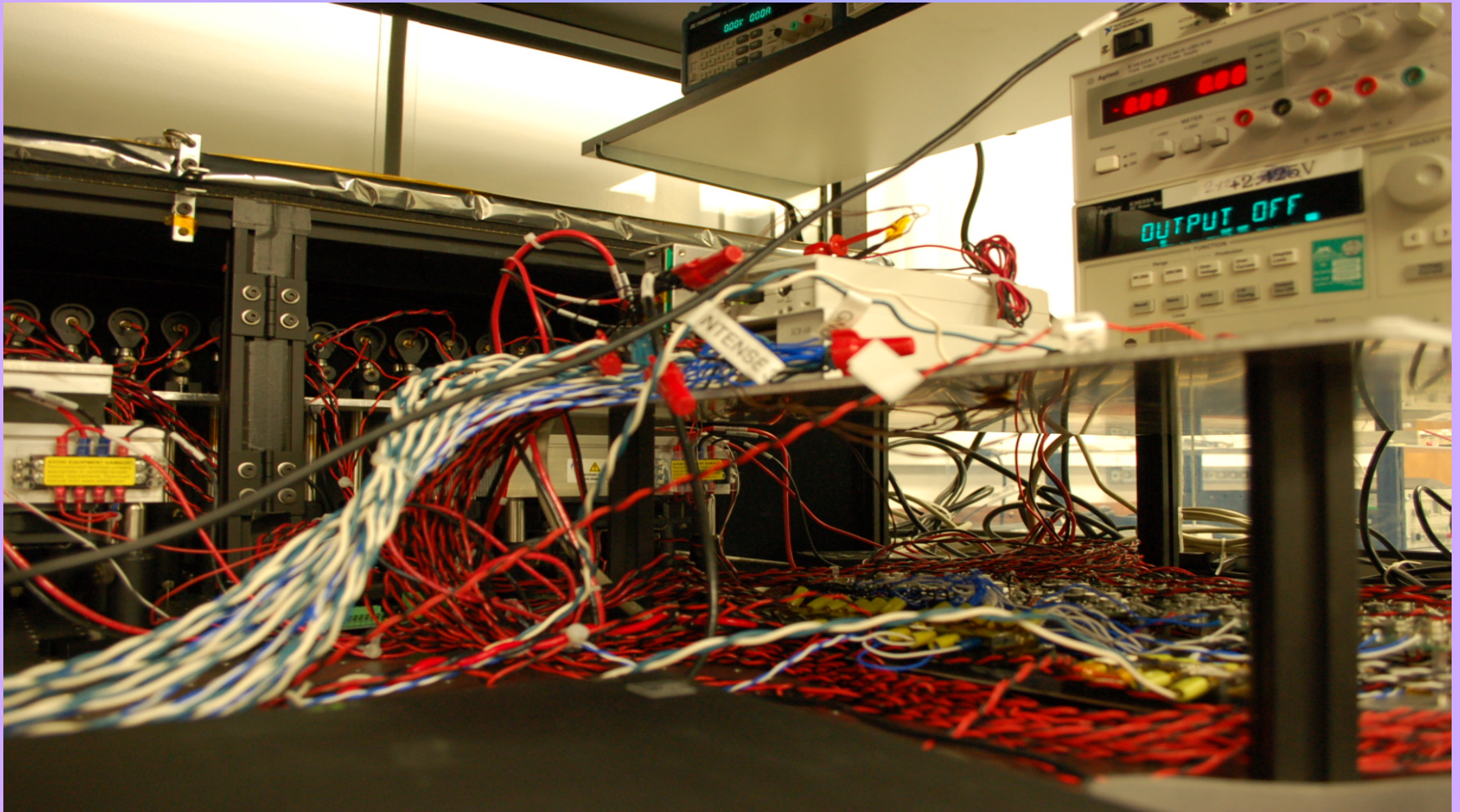


PROJECT ADJUSTMENTS

- Untangle Everything
- Re-Solder Broken Connections
- Track Down Missing Components
- Consolidate Project Into Smaller Space
- Realign Optics
- Lock Down Components
- Mark Wiring/Power Supplies for Identification
- Develop Test Procedures

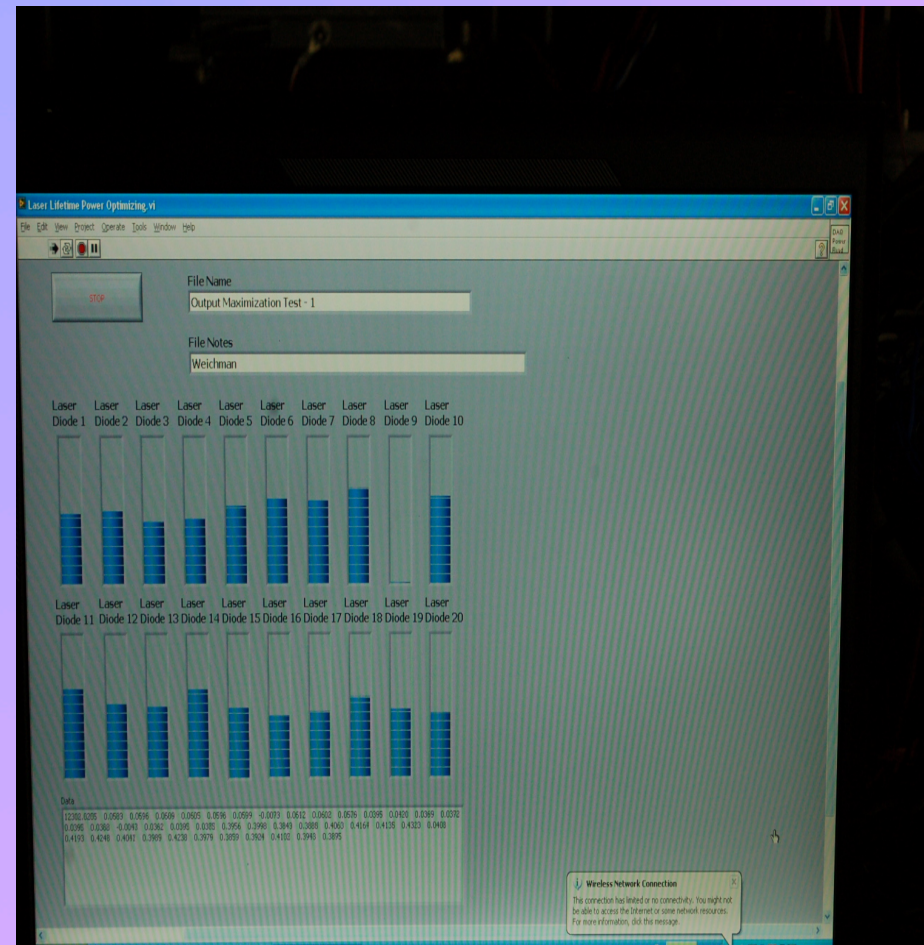


LOTS OF WIRES!

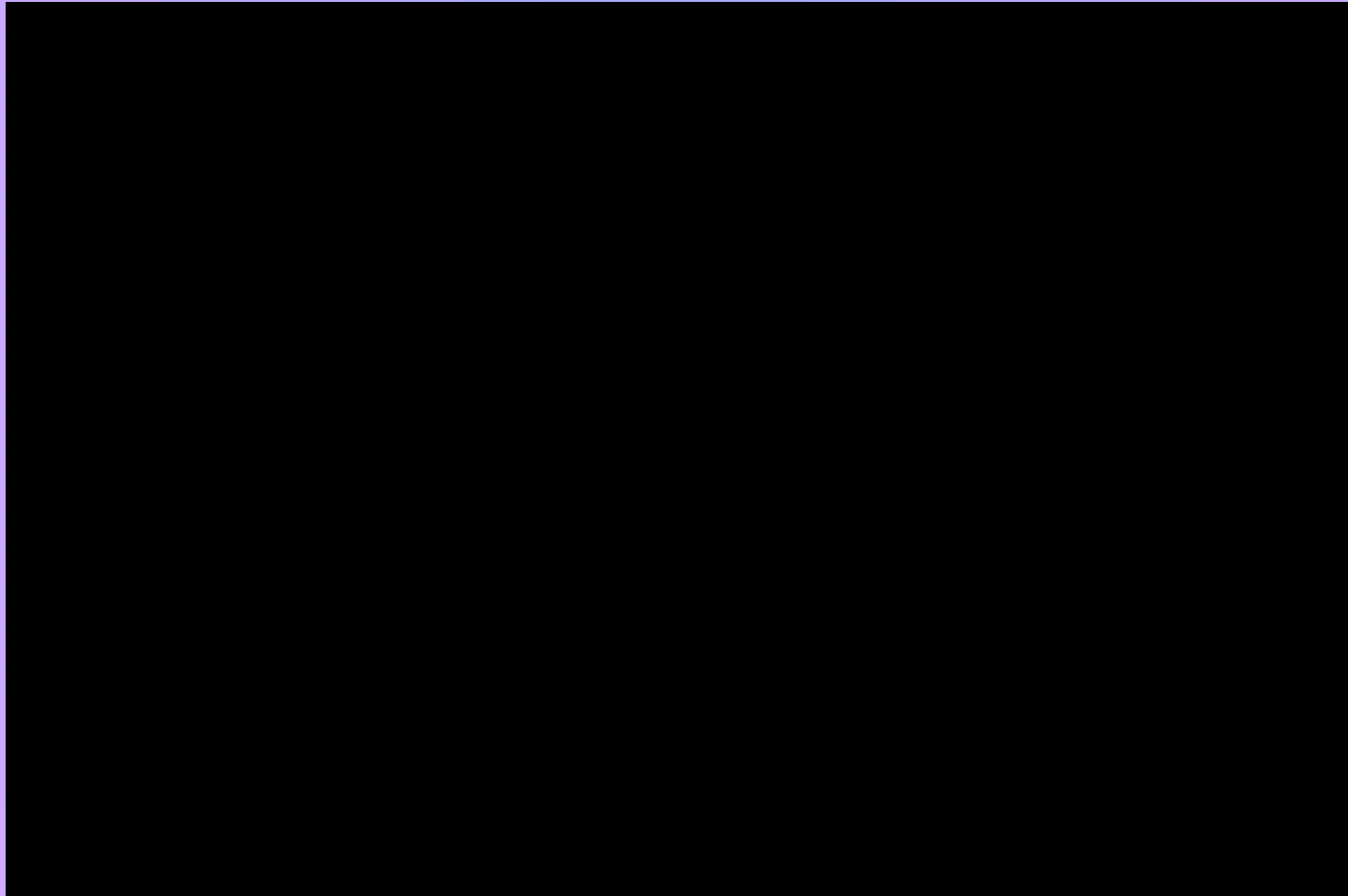


OPTIMIZATION WORK

- Not all lasers functioning at optimal levels.
- Some lasers were on but not generating an output.
- Some lasers were not working at all. One had to be removed, and another had a bad soldering connection that was fixed and is now working properly.

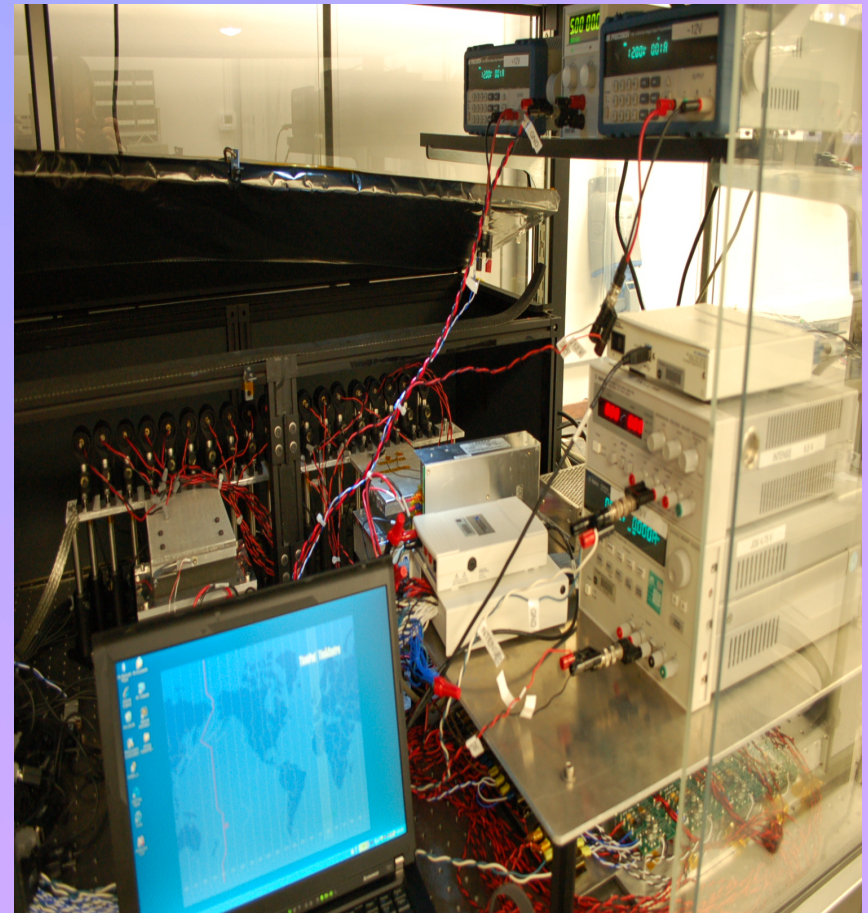


VIDEO OF OPTIMIZATION



CURRENT STATUS

- Finalizing safety paperwork prior to running lasers for extended period.
- Once lasers have been turned on, will continue until all lasers have died out.
- Based on current diode laser knowledge, anticipate several months before project expiration.
- Statistical database will be established for laser performance data.



ADDITIONAL PROJECT

- Previously worked on characterizing laser communication performance in a simulated space environment (vacuum).
- Monitored performance and recorded data. Also insulated tubes for simulating temperature of space.



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DISCLAIMER

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