Sandia National Laboratories' National Solar Thermal Test Facility (NSTTF)

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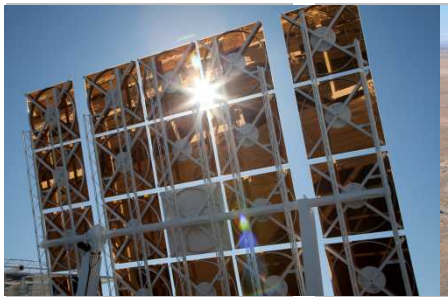
SAND2013-6905P

Exceptional service in the national interest

Sandia National Laboratories



U.S. DEPARTMENT OF ENERGY

NNSA

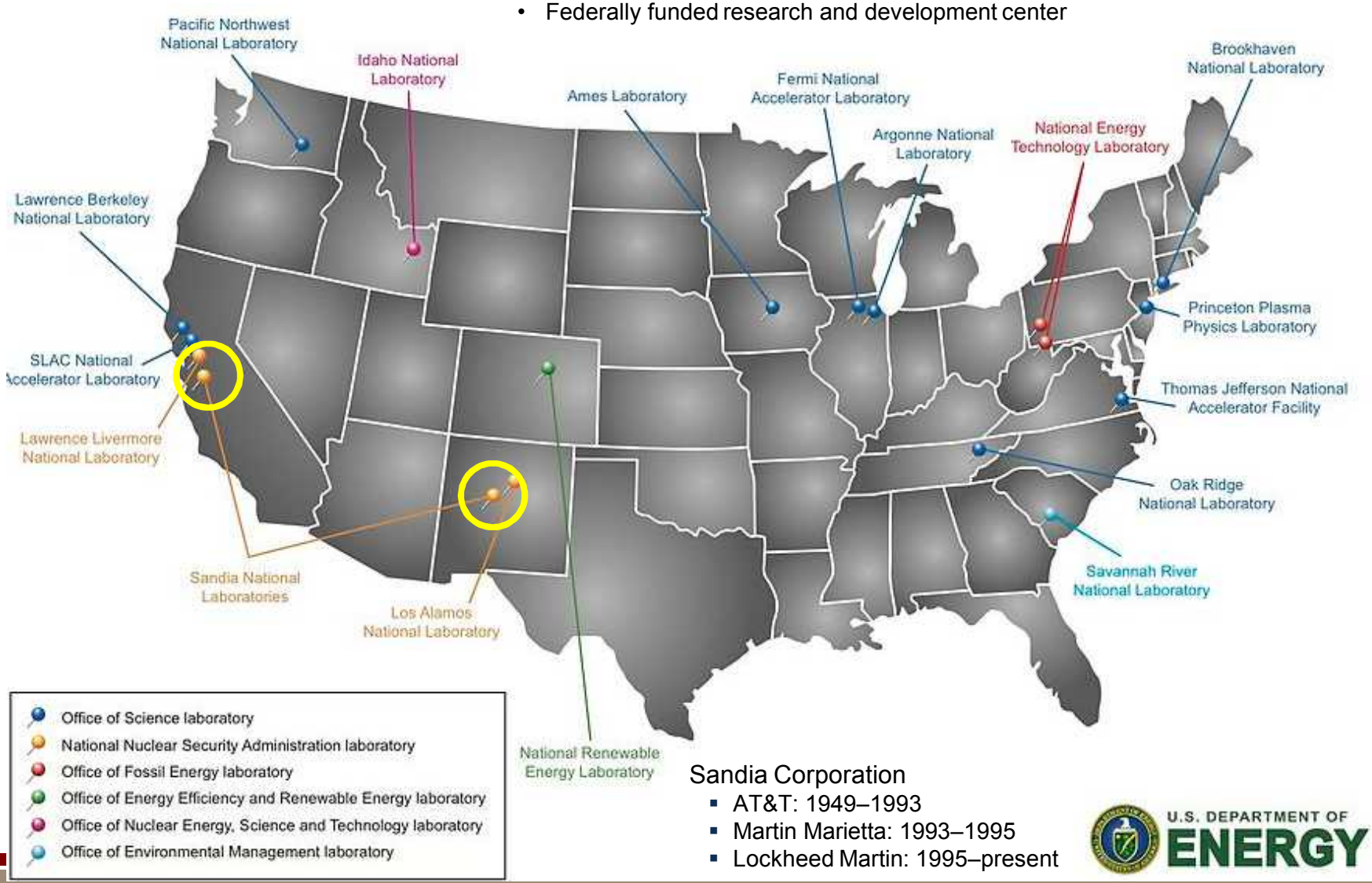
Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

Overview of Sandia

Sandia National Laboratories

One of 16 national laboratories operated by United States Department of Energy

- Government owned, contractor operated
- Federally funded research and development center



Sandia Corporation

- AT&T: 1949–1993
- Martin Marietta: 1993–1995
- Lockheed Martin: 1995–present

U.S. DEPARTMENT OF ENERGY

Albuquerque, NM

Population: ~600,000

National Solar Thermal Test Facility

Parabolic Trough R&D

Dish Stirling R&D

Optics Lab

Molten Salt Test Loop

Receiver, Heliostat, and Materials Testing

Solar Fuels and Selective Absorbers

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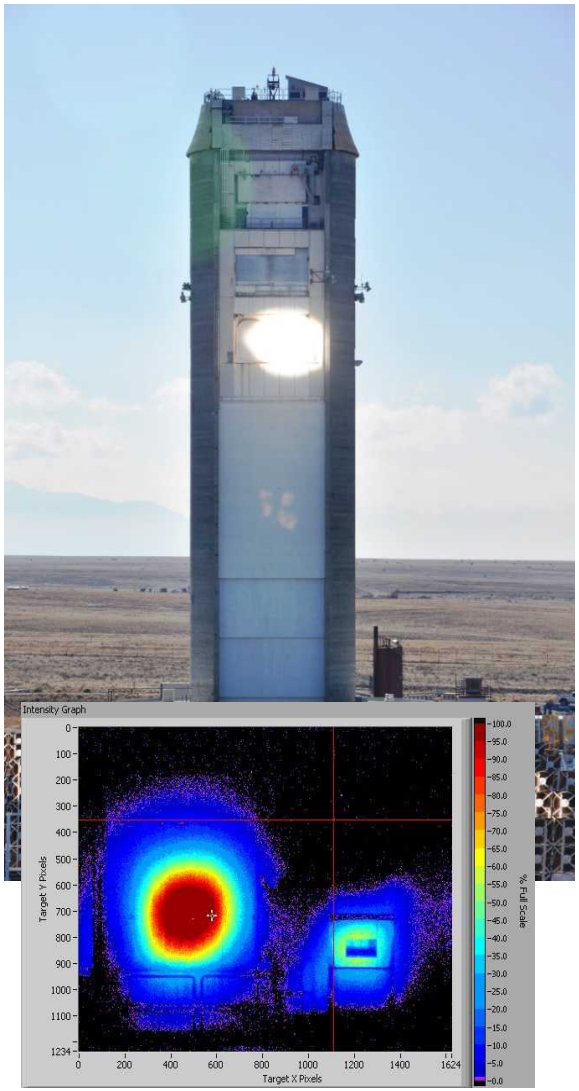
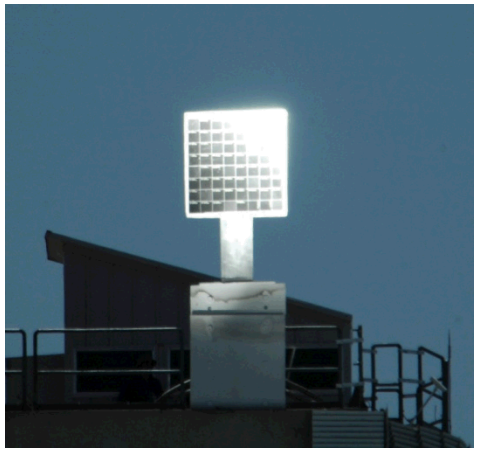
Tower and Heliostat Field

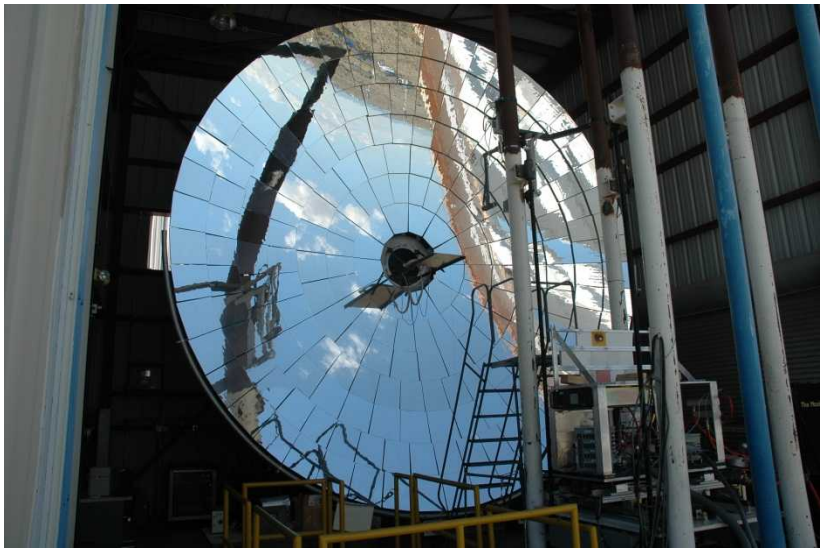
- Peak Flux: 350 W/cm^2
- Total Power: 6 MW$_t$
- 218 heliostats
- Tower (200 ft) 3 test bays plus top of tower
- Testing of receivers, heliostats, materials, and subsystem components

Tower Test Locations





Solar Furnace



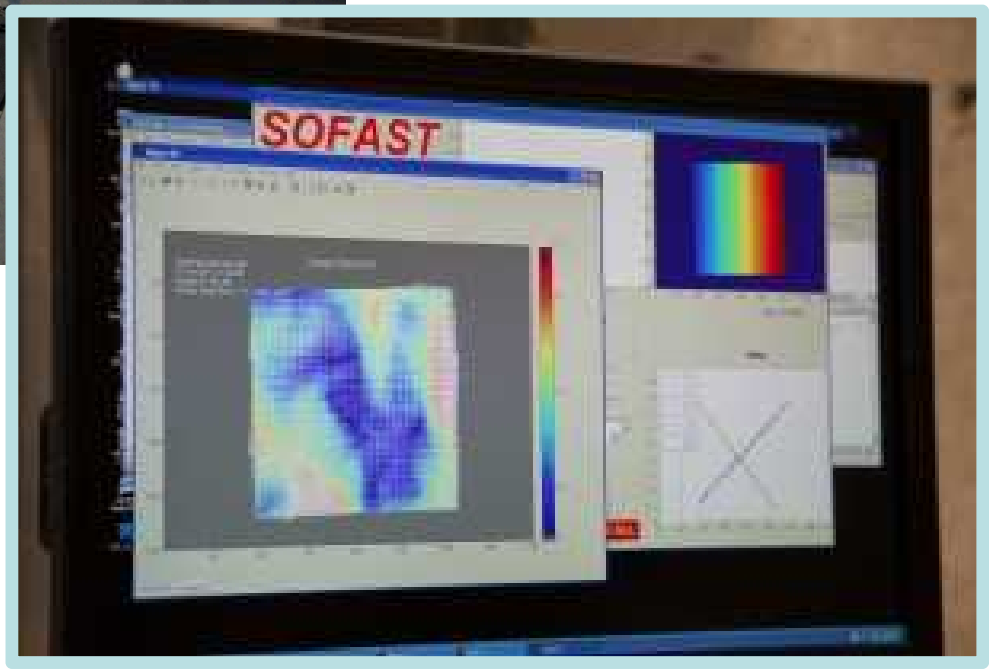
- Peak Flux: 600 W/cm^2
- Total Power: 16 kW_t
- Materials testing, calibration, proof of concept testing

Molten Salt Test Loop

- Operating Temp: up to 585 C
- Max pressure: 40 bars (580 psi)
- Flow rates variable: up to 600 gpm (0.038 m^3/s)
- Three test loops
- Component and system testing
- Accelerated life-time testing

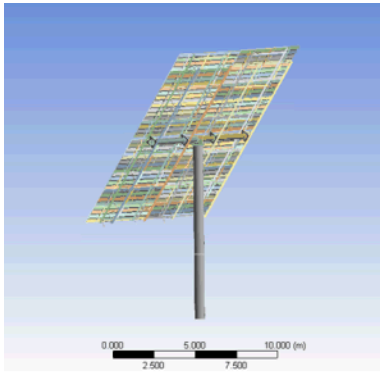
Optics Lab

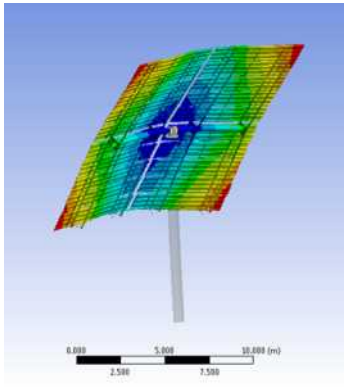
Optical characterization of collector facets, PV modules



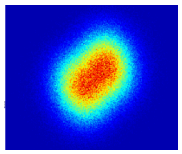
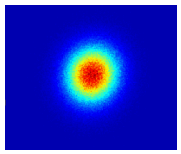
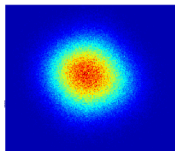
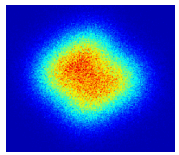
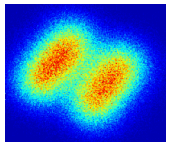
Examples of Research Activities

Optical Accuracy – Gravity Sag





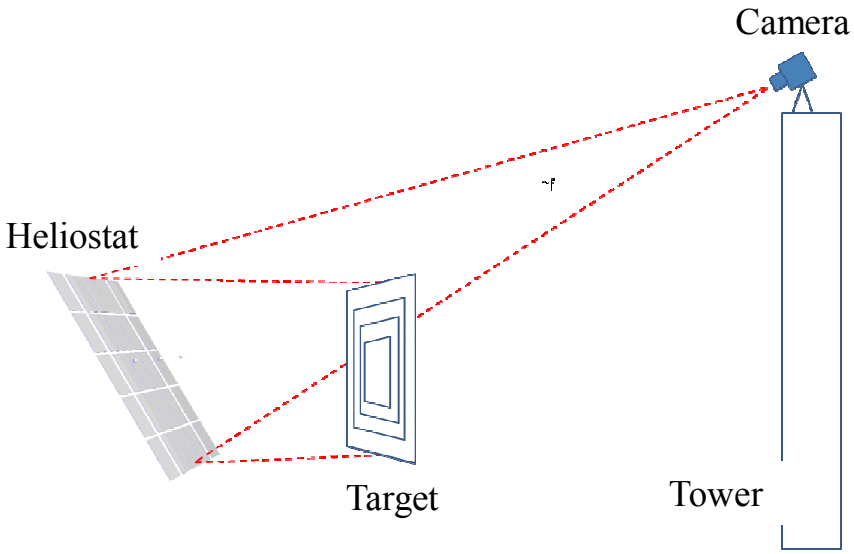
Mirror canting and gravity sag can affect optics
(J.Yuan)

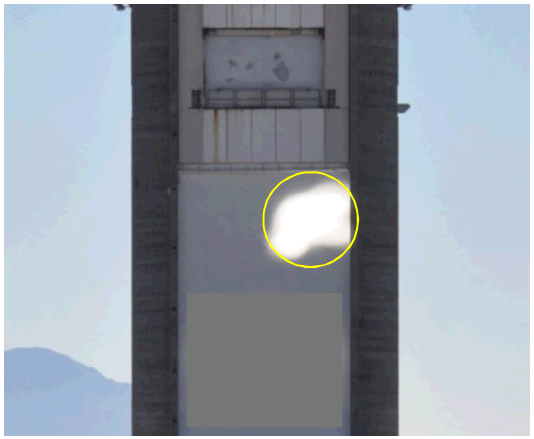
Time	10:03 AM	12:30 PM	3:12 PM	4:12 PM	5:45 PM
Actual BCS Contour Plots					
Simulation					

August 23

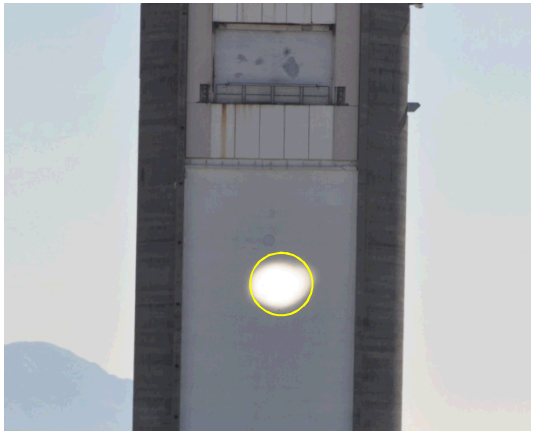
Optical Accuracy – Characterization, Alignment, and Tracking

(Andraka, Yellowhair, Smith)



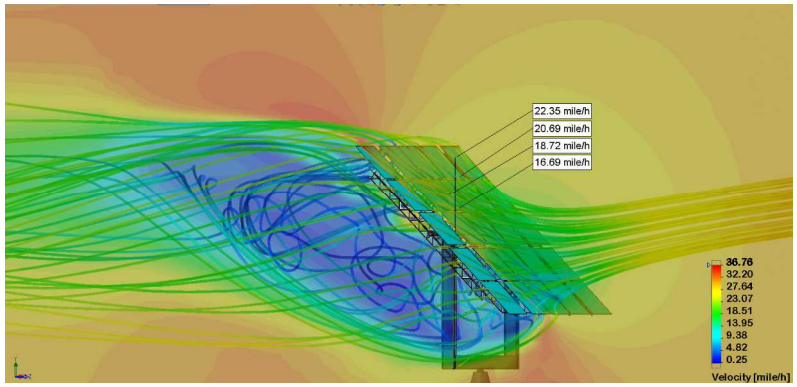


Before

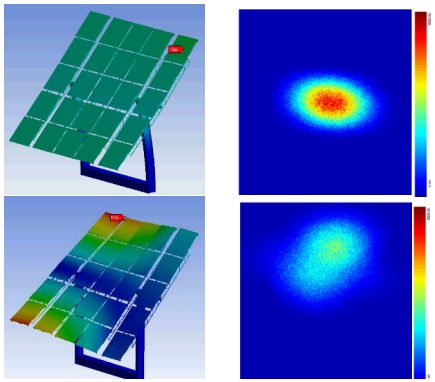


After

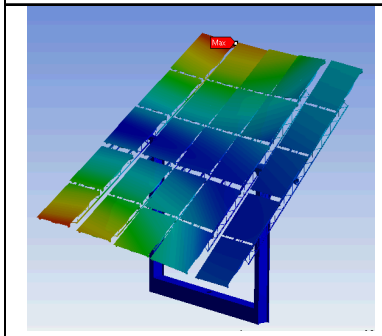
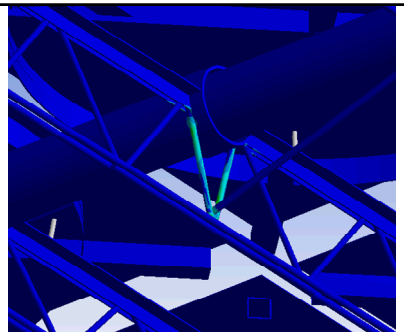
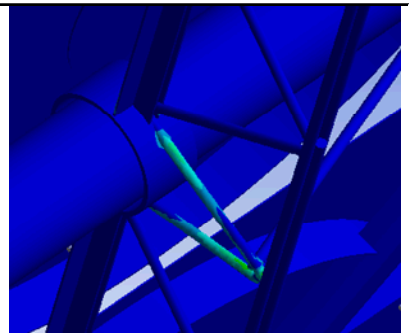
Wind Impacts – Optics and Fatigue

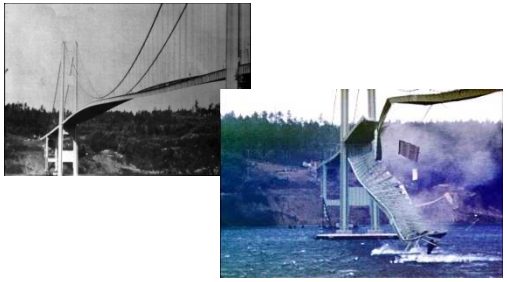


J. Sment, J. Christian, J. Yuan



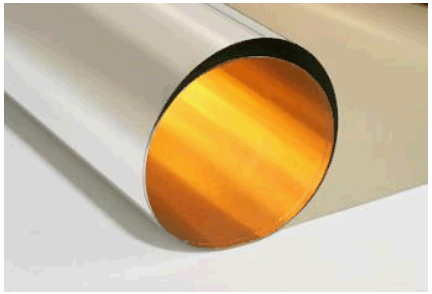
Optics impacted by "sway" or out-of-plane bending

Mode shape	Fatigue Affected Areas
	 
Mode 2	Truss Cross Members at Torque Tube

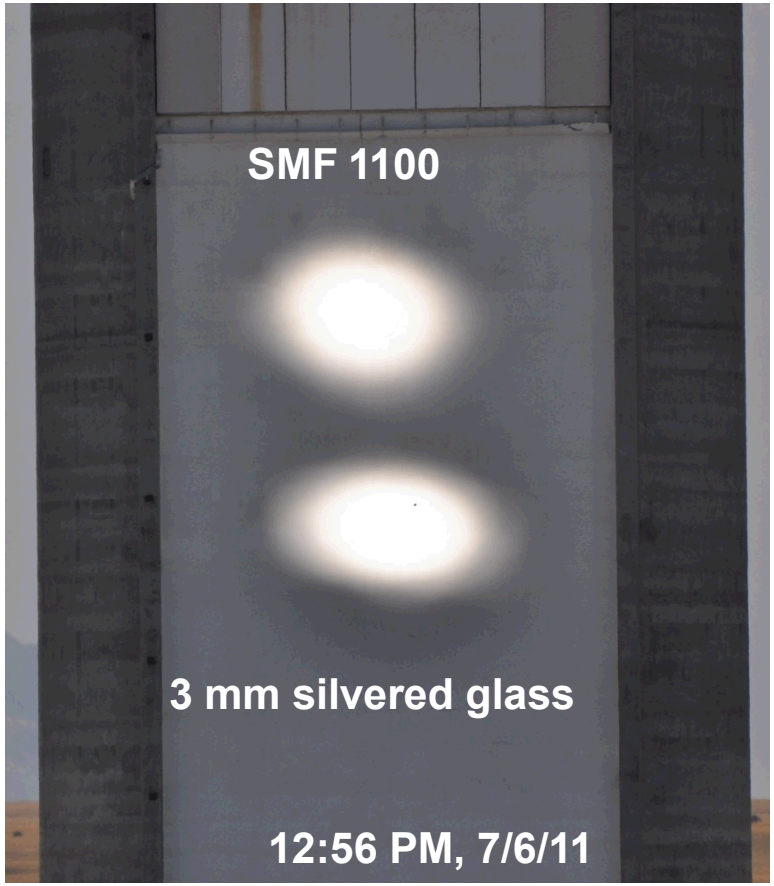


Tacoma Narrows Bridge collapsing under 40 mph winds (1940)

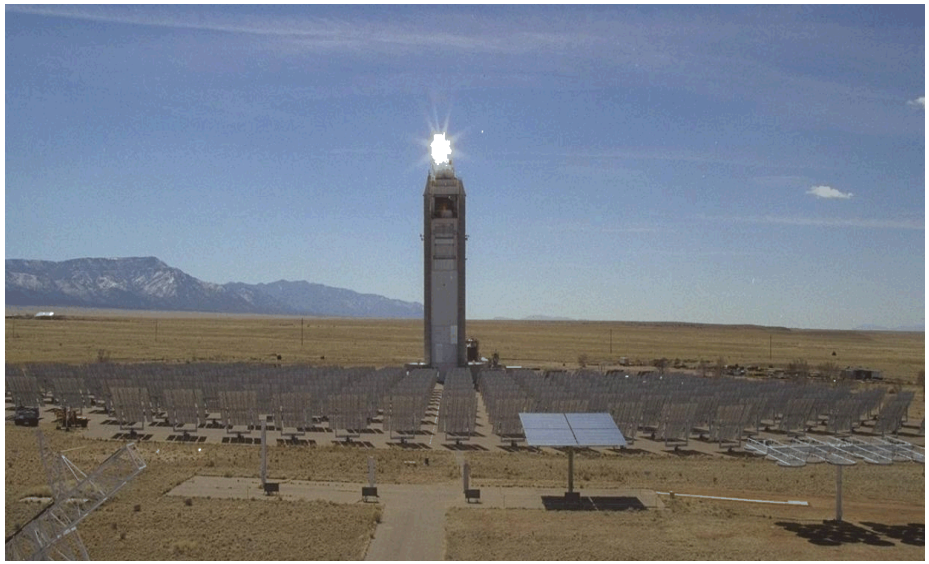
Advanced Reflective Materials



Heliostat with 3M™ Solar Mirror Film 1100



High-Temperature Receivers



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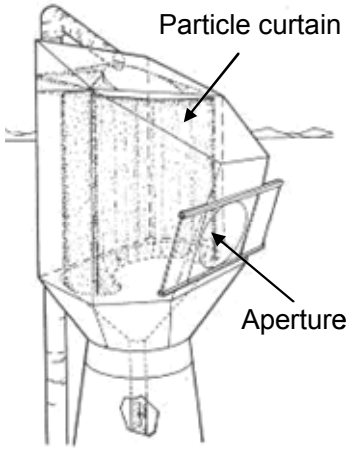
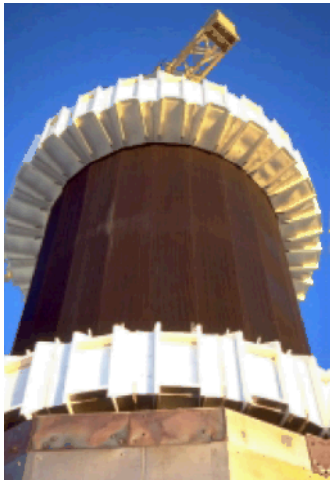


Falling particle receiver



External tubular receiver

- Maximize solar absorptance and minimize heat loss (selective absorber coatings, geometry, concentration ratio)
- Need materials that operate at high temperature (>650 °C) and are durable in air

Questions?

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