

# The Historical Development of SORCE (looking back to the future)

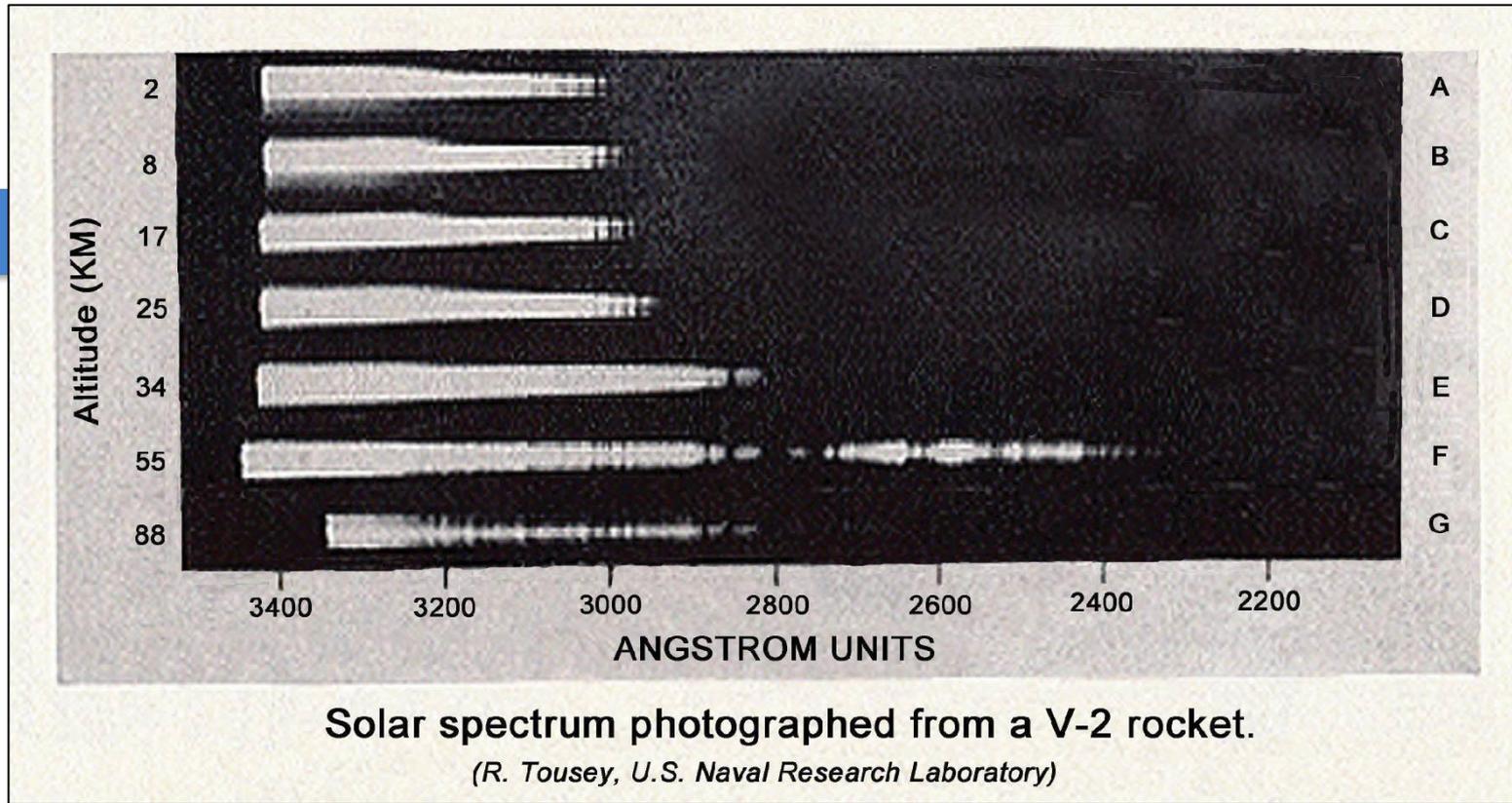
## Historical Fiction:

- Setting is drawn from history, it contains historical persons, pays attention to historical detail
- Artistic license is permitted in regard to presentation and subject matter, so long as it doesn't deviate from established history (Alternate History)

G. Rottman and T. Woods

LASP — University of Colorado, Boulder

# First Space Observations of the Sun



1950

1960

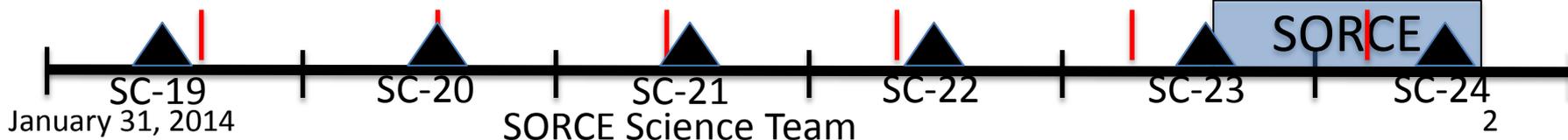
1970

1980

1990

2000

2010

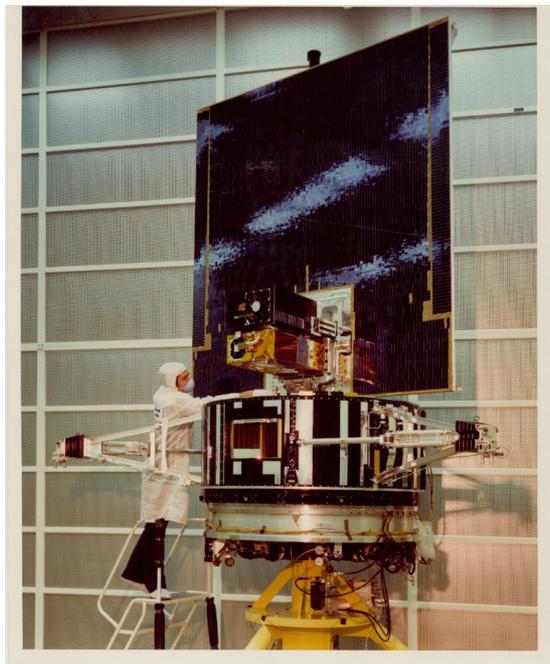


# Graduate Work at JHU

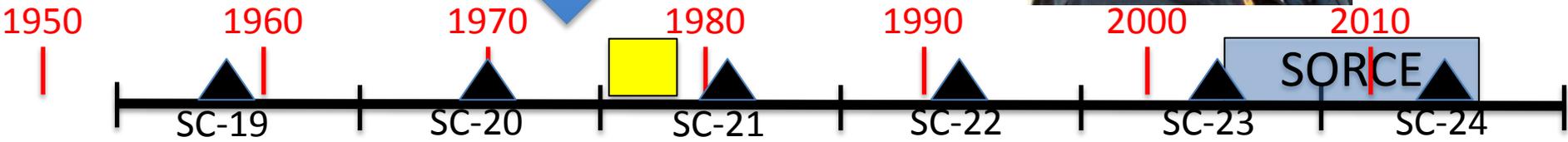
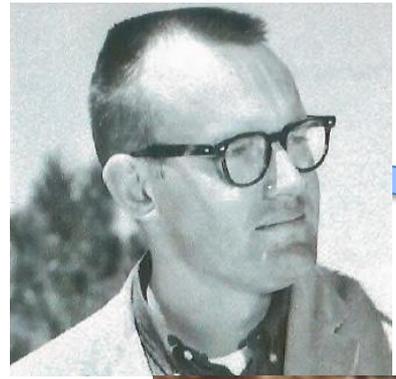
- 1966 to 1972 at Johns Hopkins
- Rocket observation of planet Venus
- Large precision pointed telescope with small **prism UV spectrometer**
  - High throughput
  - Low scattered light
  - No overlapping spectral orders
  - Highly stable
- Analyses required solar irradiance
  - (apparently factor of 2 uncertainty)

## My Arrival in 1972 at CU Boulder — LASP

George Lawrence



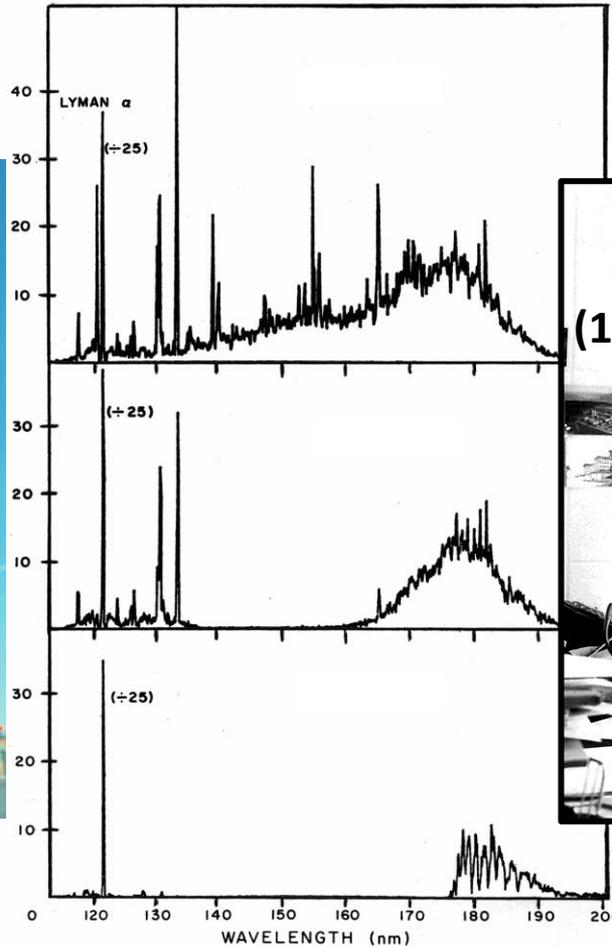
Dick White



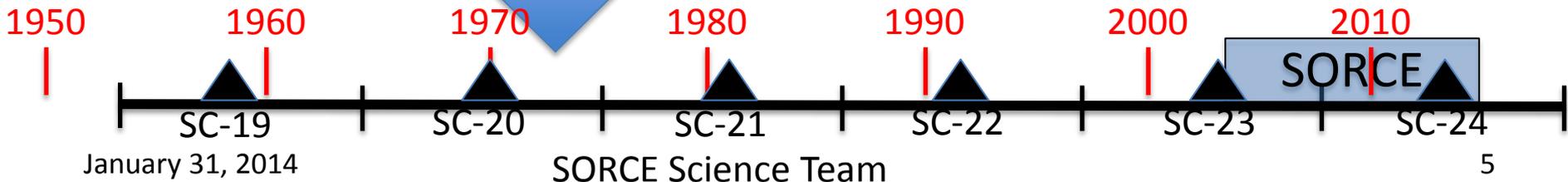
January 31, 2014

SORCE Science Team

# LASP Irradiance Program

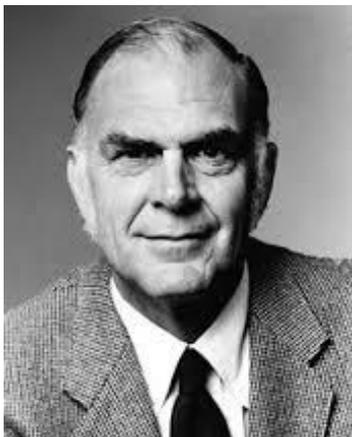


**Julie London  
(1917 to 2009)**



# Ozone Depletion

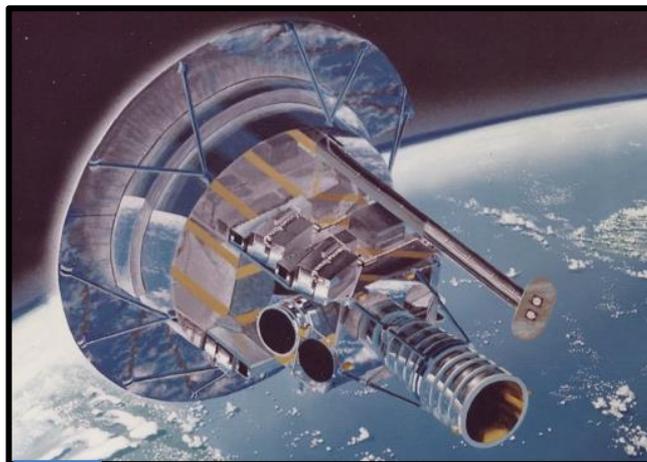
Rowland



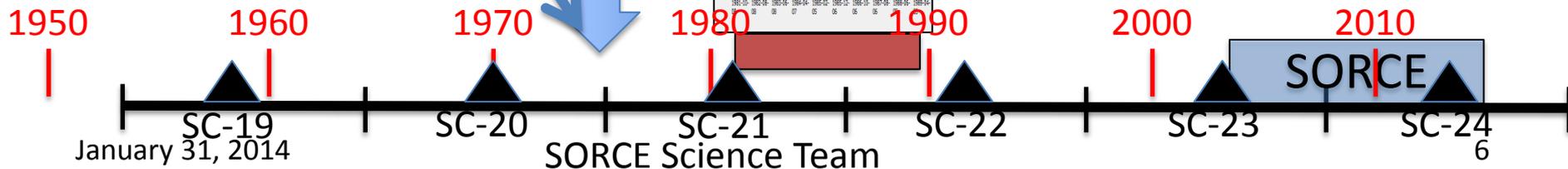
Molina



## SME



## Ozone Depletion



# UARS (SOLSTICE)

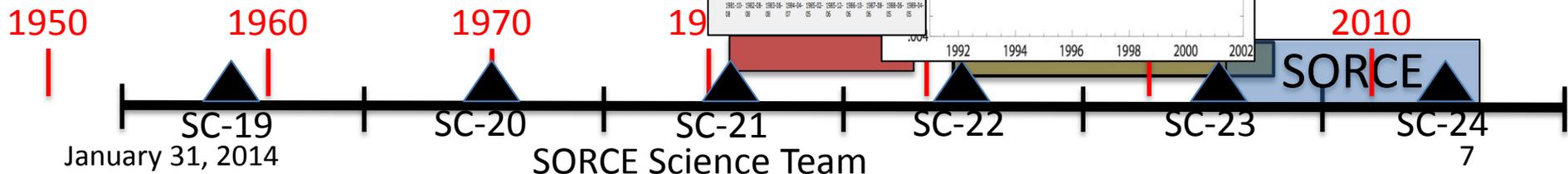
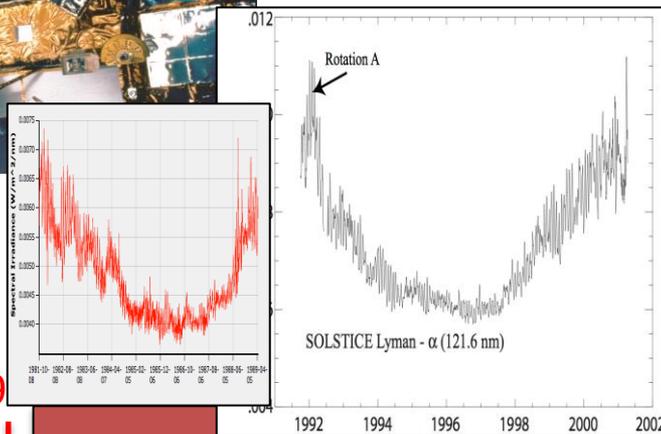
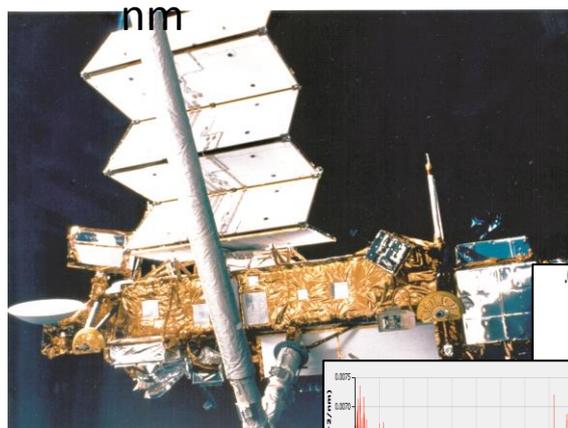
## Proposal and Selection



William G. Fastie  
(1916-2000)

### Solar Stellar Irradiance Comparison Experiment

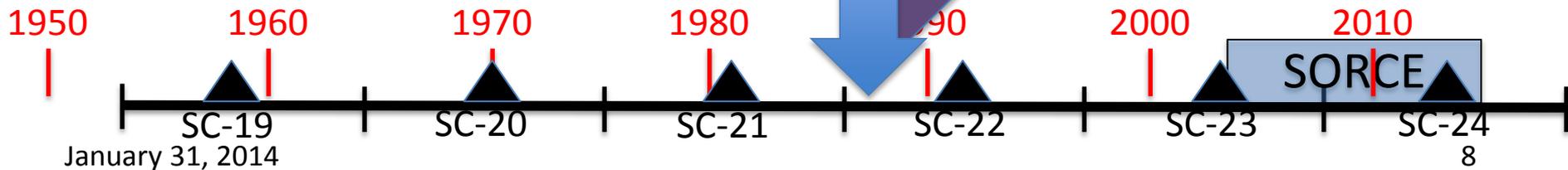
- Directly compare the Sun to bright blue stars
- <1% accuracy
- 110 to 180 nm, 180 to 300nm, 300 to 400



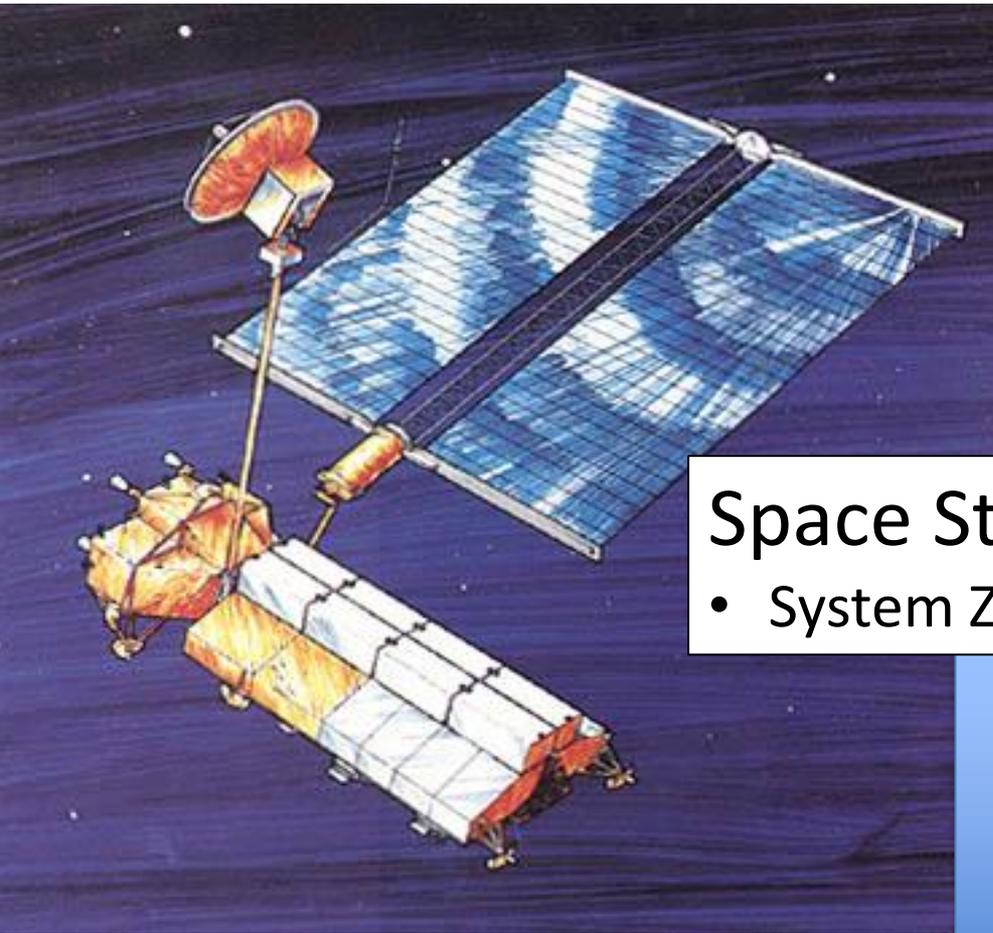
# Tom Woods joins UARS and Initiates the EUV Program



EUV Program



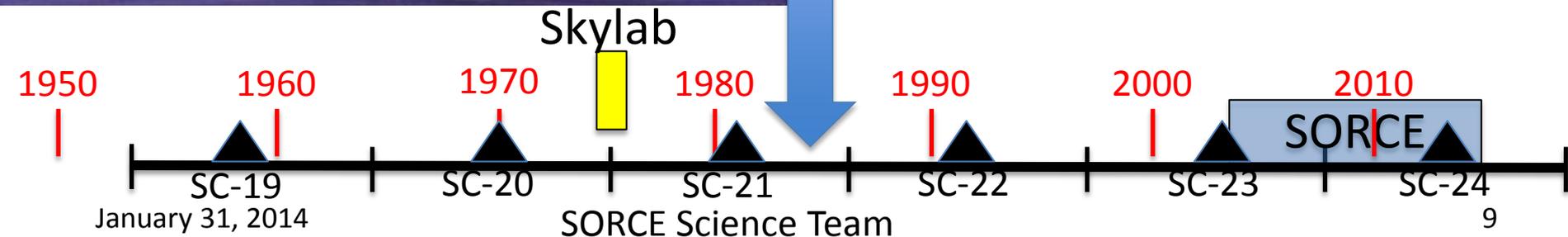
# Lead-in to EOS



Space Station Freedom (new Start)

- System Z

EOS AO 1988 (458 Proposals)  
 Selection 1989 (30 Instruments)



# EOS Beginning in 1989

- Letter of acceptance in February 1989
- All-Hands Meeting of IWG in March 1989
  - ✓ EOS budget of \$17B
  - ✓ The Polar Platforms would carry 30 instruments
  - ✓ Platform and instruments will be designed for a 15 year mission
  - ✓ Data rates of 100 to 300 MBps +++++
  - ✓ Stored on 9 track tapes — constant building construction
  - ✓ EOS SOLSTICE is a Flight of Opportunity

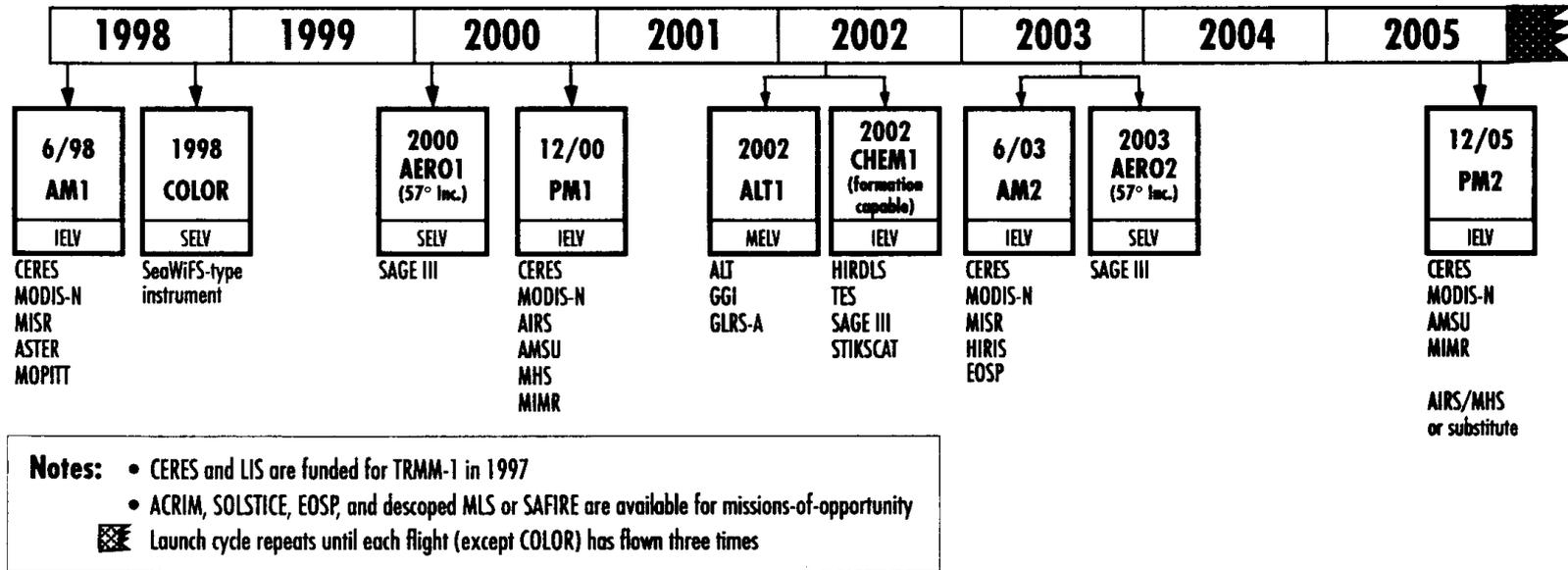
# Environmental Data Records (EDR's)

EOS Instruments are designed to measure the following environmental variables

- Cloud properties
- Energy exchange between Earth and space
- Surface temperature
- Structure, composition, and dynamics of the atmosphere, winds, light
- Accumulation and distribution of snow and ice on the surface waters
- Biological activity in the surface waters
- Circulation of the atmosphere
- Exchange of heat, water, and gases between the surface and atmosphere
- Growth and retreat of sea ice; growth, melting, and retreat of glaciers
- Chemical composition of exposed soils and rocks
- Changes in stress and surface elevation around geologic faults
- Input of solar radiation and energetic particles to the Earth.

**Take today's data today  
It will not be available tomorrow**

# Finding a Flight of Opportunity (FOO)



**Figure 4. Restructured EOS Launch Profile (March 1992)**

# New EOS Vocabulary (Re-.....)

- Restructuring in March 1991, budget ↓ \$11B and 17 instruments
- Rescoping in 1992, budget ↓ \$8B
- Rebaselining in 1994, budget ↓ \$7.2B
- Reshaping in 1995

# SOLSTICE Re-design (1996)

- ✓ UARS SOLSTICE (300 to 400 nm) channel provided 1% accuracy >> solar variations
- ✓ Needed instrument with a reliable, stable detector — G. Lawrence developed the miniaturized ESR
- ✓ Desired an instrument (300 nm to 2 $\mu$ m) with a single, figured prism — G. Mount helped develop the SIM
- ✓ Instrument should be self calibrating

# TSIM Announcement of Opportunity (1997)

- Science Objective: to continue TSI measurement
- **(Optionally) provide two spectral measurements  
~ 200 – 300 nm, and 1500nm**
- MTPE PI-mode of Mission Management
  - End-to-end mission design (5-year)
  - Instrument development
  - Spacecraft acquisition
  - Command and control of spacecraft
  - Algorithm development

# The SORCE Mission

- LASP was selected to provide *TSIM* in 1999
- LASP was already well on its way to provide *EOS SOLSTICE* as a PI mode investigation
- NASA agreed to combine the two into a single *SORCE* Mission
- Bob Cahalan at GSFC was appointed as *SORCE* Mission Scientist
- LASP selected Orbital Sciences Corp to provide the *SORCE* spacecraft
- *SORCE* was launched January 25, 2003

# Special People



# Recommendation for the Future

- Continue to improve TSI and SSI techniques
- Continue overlapping observations
- Procure dedicated and quality spacecraft
  - Lifetime of  $> 5$  years
  - Pointing of  $< 1$  arc min
  - $\Delta$  temperature of  $< 1$  C°
- Reliable launch to LEO  $\sim 600$  km
- Hot spare (integrated spacecraft and instruments) to launch within 6 months