# LWS TR&T

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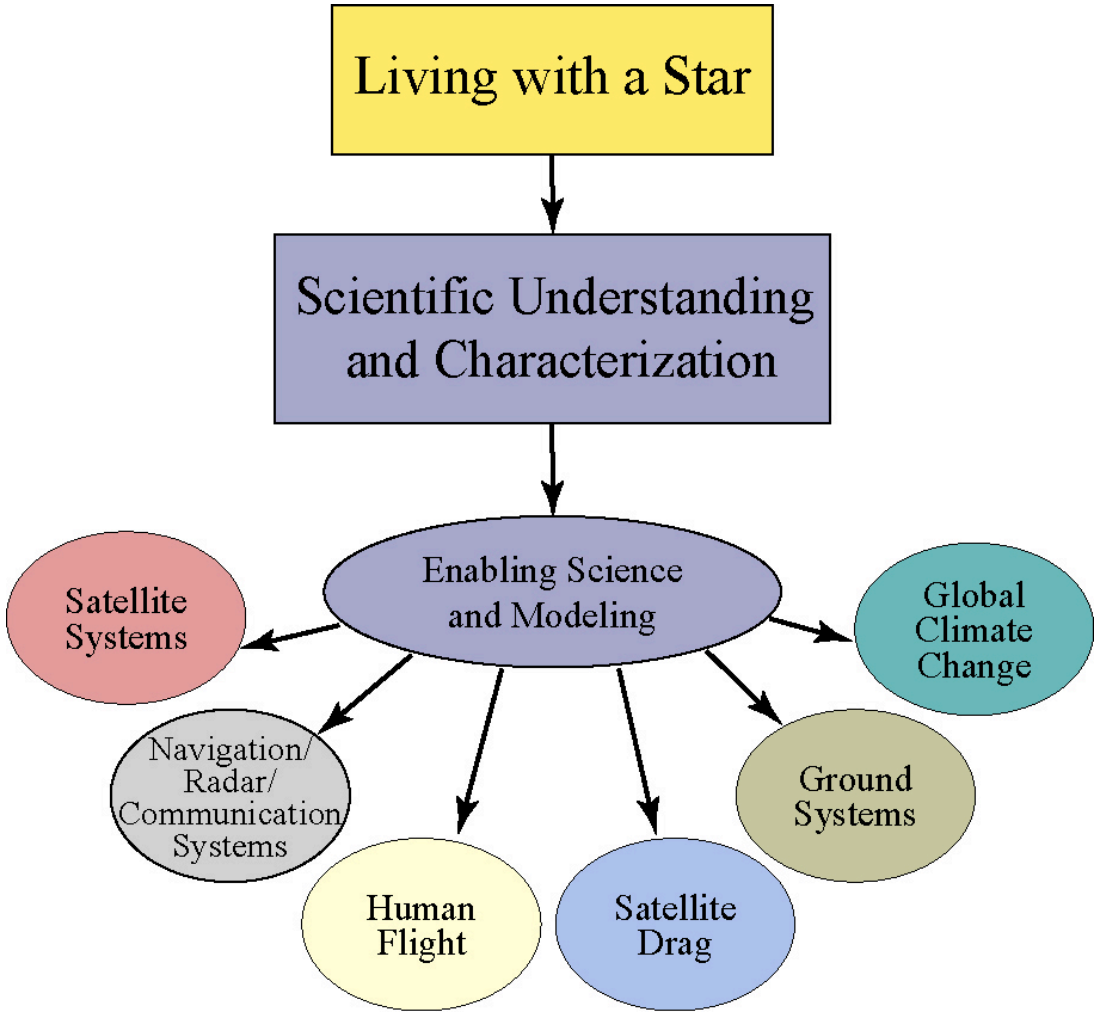
# Science Application as the Focus

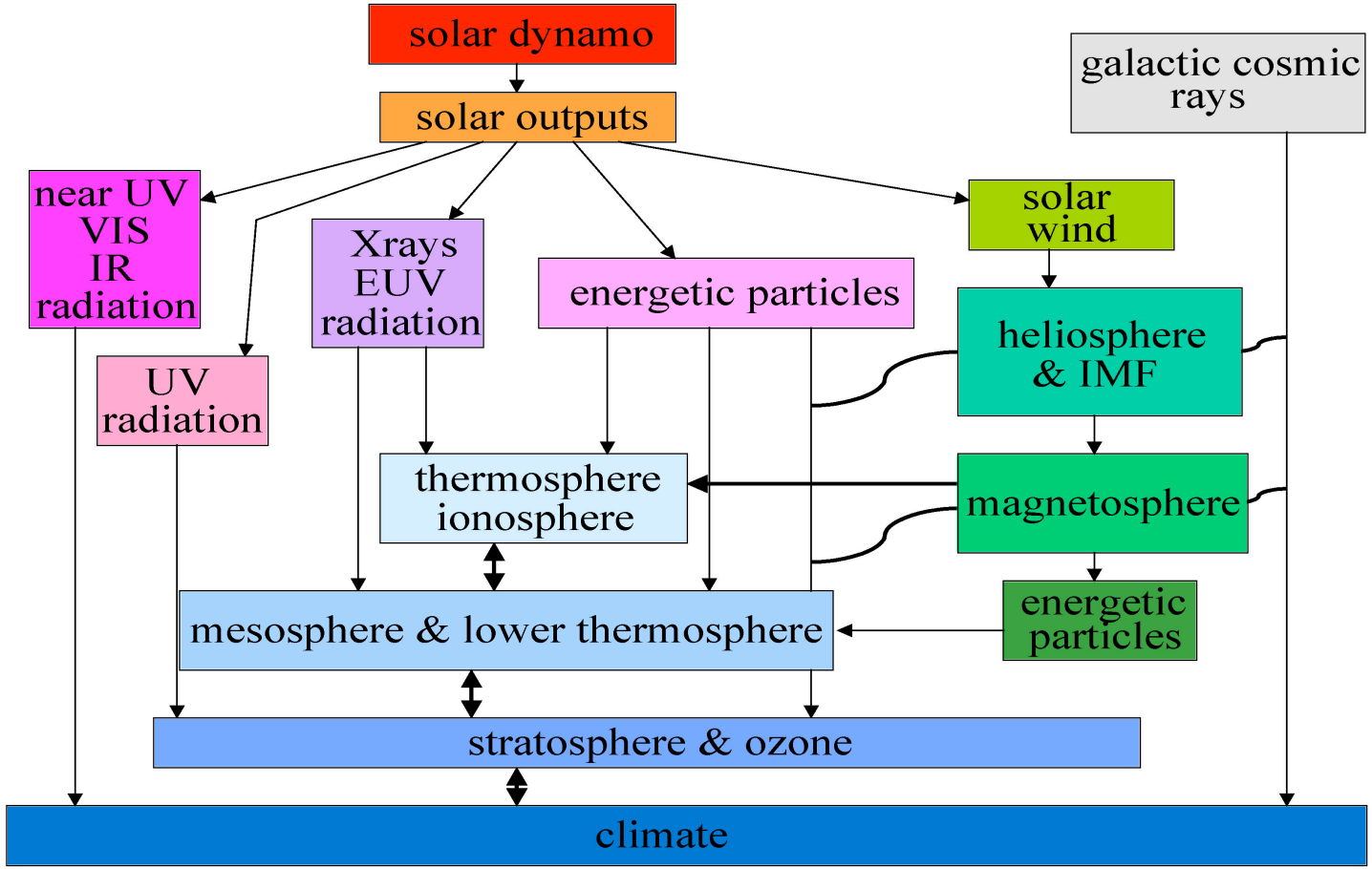
The primary goal of the LWS Program is to develop the understanding necessary to enable the U.S. to effectively address those aspects of the Connected Sun-Solar system that directly affect life and society.

- Space Weather
- Space Climate
- Sun-Climate Connection



# LWS is a Systems Approach

**LWS focuses not on any one region of space, but rather on our Sun Earth Region as one system.**




**A very important part is the study of the connection between the regions and how one drives a response in another.**

# Research Priorities Based on Report
# Targeted Research and Technology Science Definition Team

**Research Topics:**

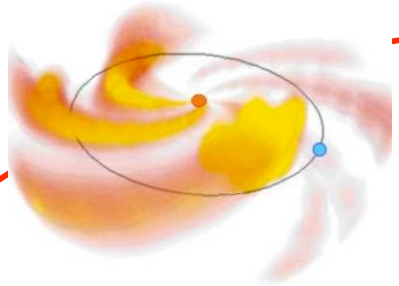
## 1.0 Effect of Solar Variability on Terrestrial Global Climate Change

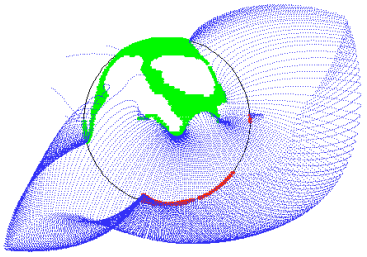
**1.1 Sun-Climate relationship**
**1.2 Stratospheric ozone change**

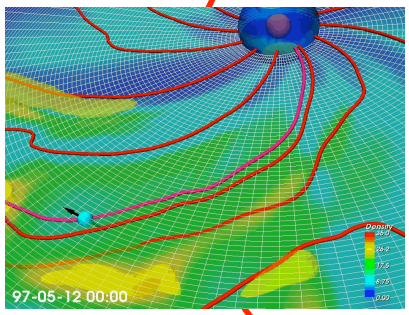
## 2.0 Space Weather

**2.1 Background ionosphere**
**2.2 Ionospheric scintillations**
**2.3 Density and composition of the neutral thermosphere**
**2.4 Geomagnetically-induced currents**
**2.5 Energetic particle environment in the magnetosphere**
**2.6 Radiation associated with explosive events on the Sun**
**2.7 Radiation from Galactic Cosmic Rays***

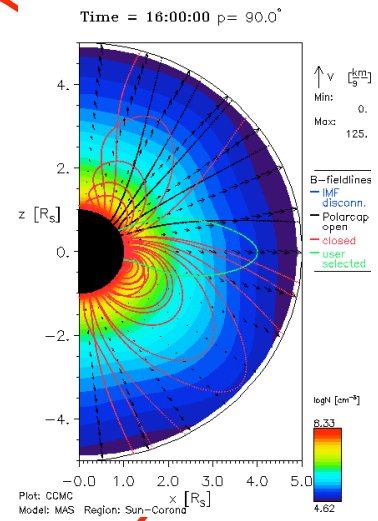
# COMMUNITY COORDINATED MODELING CENTER

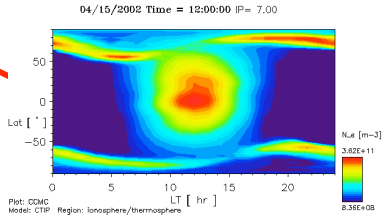


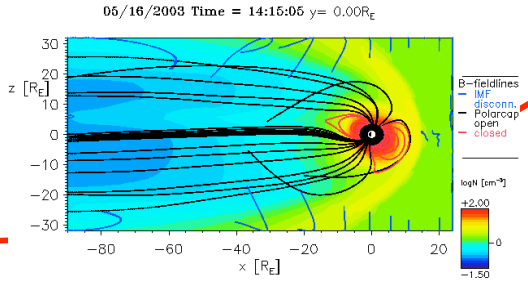


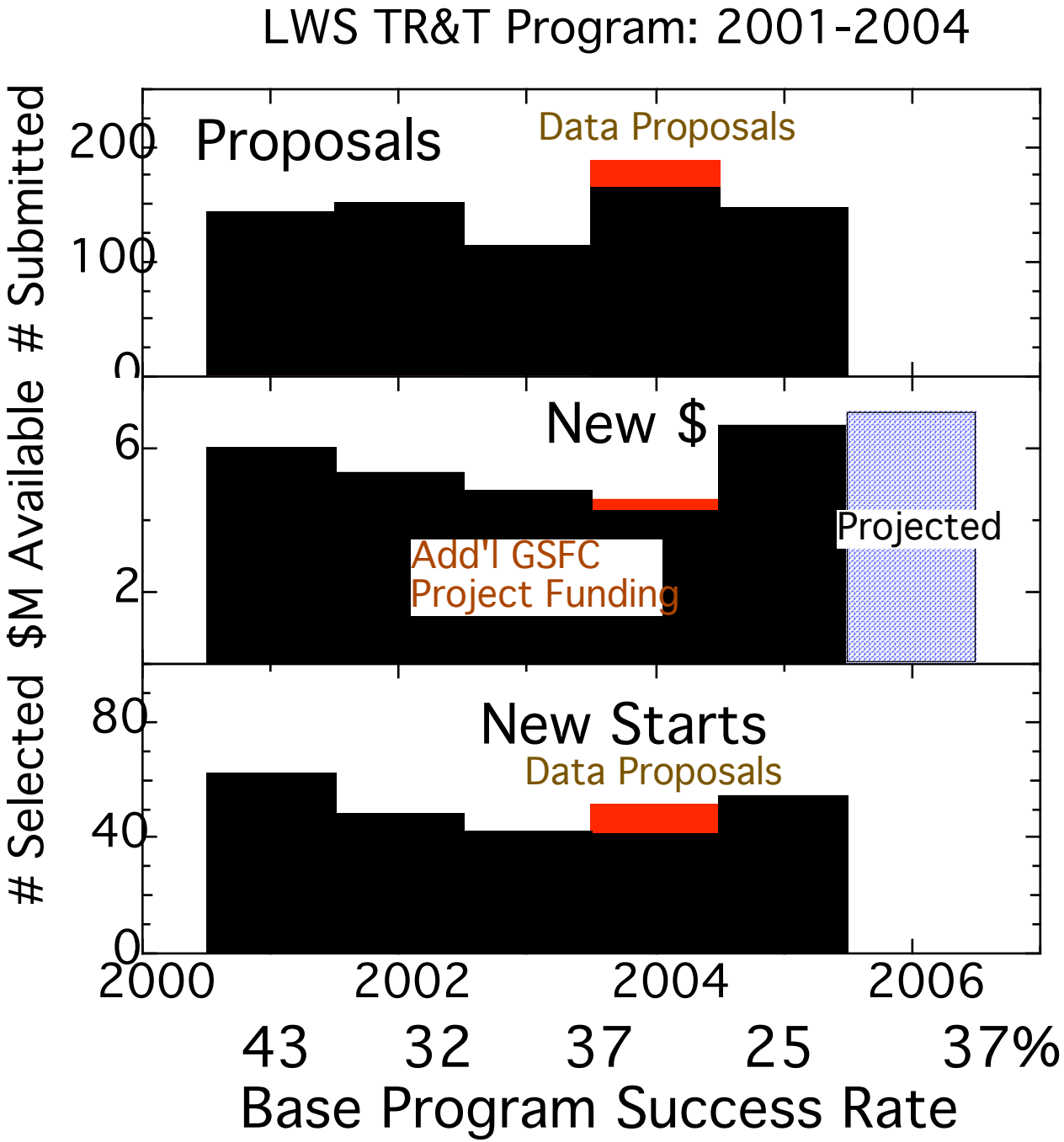



- **Facilitates Community Research**
- **Provides community use of TR&T models**
- **Supports Transition to Space Weather Operations**




LWS TR&T Program: 2001-2004
# Selected $M Available # Submitted
Proposals
Data Proposals
200
100
0
New $
6
2
Add'l GSFC
Project Funding
Projected
New Starts
Data Proposals
80
40
0
2000
2002
2004
2006
43
32
37
25
37%
Base Program Success Rate

# Report of TR&T Steering Committee to LWS MOWG

May 10, 2004

(TSC): Spiro Antiochos (Chair), Janet Barth, Sunanda Basu, Geoff Crowley, John Eddy, Lennard Fisk, Joe Giacalone, Mary Hudson, Neal Hulburt, Charles Jackman, Boon-Chye Low, Jimmy Raeder, Pete Riley

- Reviewed and endorsed TR&T program structure:
  - 3 elements*: Targeted investigations, strategic capabilities, & cross-discipline infrastructure building*
- *Infrastructure*:
  - ~ 15% of TR&T resources
  - Workshops/campaigns, summer schools
  - Initiate LWS Post-Doctoral Program
  - Proposal process similar to NRC program
  - Will address centers/institutes at next meeting
- *Capabilities:*
  - Will address at next meeting and define for next NRA

- *Targeted Investigations*:
- TSC defined 3 components:
  - Independent investigations ~15%
    - High urgency/impact studies
  - Tools and methods ~ 10%
  - Focused science targets ~ 75%,
- Rationale:
  - Need effective new approach to addressing major multi-discipline problems
  - Requires teams that draw from whole community
- Implementation:
  - Science targets recommended to NASA with community input
  - Review panels organized according to targets
  - Selected investigations organized into team
    - Team defines success measures/deliverables for integrated effort
  - Team coordinator chosen from winning PIs

LWSResearch and Technology (TR&T) program element solicits proposals leading to a physics-based understanding of the integral system linking the Sun to the Solar System both directly and via the heliosphere, planetary magnetospheres, and ionospheres. The past NRA NRA-04-OSS-01 solicited proposals in the following three categories

- **1. Independent Investigations**
  **2. Tools and Methods**

  **3. Focused Science Topics**

  **The Focused Science Topics was further sub-divided into the following six objectives:**

- **i. To quantify the sensitivity of regional and global climate to solar forcing in the full context of the interactive climate system.**

- **ii. To quantify the response of thermospheric density and composition to solar and high latitude forcing.**

- **iii. To determine the mechanisms responsible for the formation and loss of new radiation belts in the slot region in response to geo-effective solar wind structures.**

- **iv. To relate solar-energetic particles to their origin at the sun and inner heliosphere.**

- **v. To determine the topology and evolution of the open magnetic field of the Sun connecting the photosphere through the corona to the heliosphere.**

- **vi. To determine the solar origins of the plasma and magnetic flux observed in an Interplanetary Coronal Mass Ejection.**

# Team Leaders Selected Last Year

- Desai (PI), Solar energetic particles event
- Zurbuchan (Co-I on Fisk), Modeling the open flux of the Sun
- Liemohn (PI), The Storm-Time ring current
- Mikic (PI), The Sun and CMEs
- Nathan (PI), Solar cycle and climate
- Richmond (PI), Magnetospheric effects on thermosphere

# Information on TR&T

- For additional information see Research Opportunities in Space and Earth Sciences - 2005 at: http://nspires.nasaprs.com/external/viewrepositorydocument/225/ROSES2005.pdf (LWS TR&T information can be found in section A.21 on page number 145)
- http://lws-trt.gsfc.nasa.gov/
- http://lws-trt.gsfc.nasa.gov/trt_steercom05.pdf

Spiro Antiochos (Chair), Nick Arge, Janet Barth, John Bieber, Tom Bogdan , John Eddy, Bela Fejer, Tamas Gombosi, Michael Hesse, Marty Lee, Bill Lotko , Robert McCoy, Douglas Rabin, Jimmy Raeder, John Raymond, David Rind, Sam Yee

# TR&T Steering Committee Focus

Most of the deliberations concerned three topics:
(1) implementation and selection of the FY06 *focused science topics*,
(2) implementation and selection of the FY06 *strategic capabilities*, and
(3) possible partnerships of the TR&T Program with the NSF and NCAR.

# 2005 Competition

- ~$6M in new funds available
- ~$5M for LWS TR&T Competition
  - ~10% for tools
  - ~15% for independent proposals
  - ~75% for focused research areas
- ~$1M for Strategic Capability initiative with NSF

- Cross-disciplinary infrastructure augmentations welcome: workshops, summer schools, post-docs

# Focused Science Topics

- Particle acceleration by CME shocks
- Heating and acceleration of the solar wind
- Plasma entry and transport within the magnetosphere
- Storm effects on mid- and low-latitude electrodynamics
- Greenhouse gas abundance effects on upper atmosphere temperature and dynamics

# Motivation for Strategic Capabilities

- Both NSF and NASA have found ways of funding very large projects with costs that are on the order of $1M or more/yr.
- Both NSF and NASA fund small research grants with costs on the order of $100K/yr.
- BUT there are some modeling collaborations that would make sense at an annual cost ~$500K/yr and these are difficult for either agency to fund.

# Rules of Engagement

- Projects are expected to be collaborations involving two or more institutions.
- At least one institution in the collaboration must be an academic one.
- Competition will be open to all the institutions that are eligible to propose to NASA (ie NASA scientists and other government scientists typically not able to propose to NSF may propose to this program).

- Proposals will be submitted to NASA
  - Proposers must follow the rules established by each agency in the NASA NRA.
- Maximum duration of awards: 5 years
- Maximum total award size: $2.5 M (I.e. $500K/yr)

# Expected size of the competition

- NSF would provide up to $500K/yr and NASA 1 M/yr for 5 years
  - Total of $1.5M/yr available for competition
  - Three awards would be made
  - Each award may be partly funded by NASA and partly by NSF.

# Deliverables

- All models and software modules produces as a result of an award must be submitted to the CCMC for possible transition to space weather operations centers and for metric and validation testing.
- Proposals must include a description of how the resulting model or module will be validated and documented.

# Proposed Strategic Capabilities

- LWS Simulation Framework
- A Comprehensive M-I model
- Time-dependent 3D Coronal and Solar Wind Model
- Earth-Moon-Mars Radiation Model
- Seamless Ocean-Space Model

# Partnership with NCAR

- Steering Committee recommended that LWS program avail itself of an offer from NCAR to provide:
  - A meeting place
  - Modeling expertise
  - Cross-disciplinary expertise
  - Assistance with infrastructure building activities

  Unfunded, though LWS TR&T may call for proposals on these topics in future

  Supervised by NASA-convened committee