

# International Living With a Star



## Steering Committee

**H. Opgenoorth (Chair)**

**R. Marsden**

**ESA**

**W. Liu (Vice-Chair)**

**CSA**

**M. Guhathakurta**

**D. Sibeck (Exec. Sec.)**

**G. Withbroe (Sen. Adv.)**

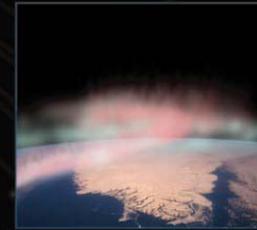
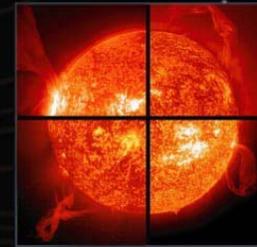
**NASA**

**T. Kosugi**

**ISAS**

**L. Zeleny**

**IKI- RSA**



# INTERNATIONAL LIVING WITH A STAR (ILWS)

## **Brief History**

- Fall, 2000: NASA proposes LWS program which is funded starting fall of 2001.
- IACG establishes Task Group to study prospects for developing an ILWS program.
- May, 2001: Task Group meets in Tenerife (in conjunction with the ESA Solar Orbiter Workshop).
- Task Group includes:
  - Four IACG agencies (ESA, ISAS, NASA, RSA) & IACG secretary.
  - CSA, CRL (Communications Research Laboratory, Japan), & NOAA (U.S.).
- Task Group concludes:
  - ILWS program has substantial potential for stimulating and enabling a new international effort in solar-terrestrial research.
  - ILWS provides an umbrella for forging necessary international coordination, cooperation, and bi-lateral and multi-lateral agency collaborations.
- January 2002: IACG accepts recommendation of Task Group to establish the ILWS program.
- September 2002: First meeting of the ILWS Working Group in Washington DC.



# Initial “Kick-Off” meeting of the International Living With A Star Working Group (ILWS-WG)

- Convened as per IACG Recommendation
- First meeting held 4 - 6 September 2002, Washington D.C. (29 attendees -27 agencies invited)
- 4 IACG members
- 7 National Space Agencies
- R. Fisher (NASA SEC Director) Meeting Chair



# Charter of the ILWS-WG I

## ILWS-WG MISSION



Inter-Agency  
Consultative  
Group

- Stimulate, strengthen and coordinate space research to understand the governing processes of the connected Sun-Earth system as an integrated entity.

International  
Living With  
a Star



# Charter of the ILWS-WG II

## ILWS-WG Objectives

- To stimulate and facilitate:
  - Study of the Sun Earth connected system and the effects which influence life and society
  - Collaboration among potential partners in solar-terrestrial space missions
  - Synergistic coordination of international research in solar-terrestrial studies, including all relevant data sources as well as theory and modeling.
  - Effective and user driven access to all data, results and value-added products



# Charter of the ILWS-WG III

## ILWS-WG Membership

- Space organizations committed to contribute to ILWS over the next decade
- Contributions to include any of the following
  - Space Flight Missions
  - Mission payloads or subsystems
  - Mission launch or tracking services
  - Additional data sources supporting flight missions (sounding rockets, balloon, or ground-based)
  - Data dissemination, storage, distribution and value adding systems
  - Supporting theory and modeling



# Provisional Guidelines ILWSP Structure - I

- The ILWS program shall have a Steering Committee comprised of one member each from CSA, ESA, Japan, NASA and Russia (+ Chairperson - 2 year rotating term).
- Initial Steering Committee Chair: **ESA** (Vice-Chair: **CSA**)
- The ILWS program shall have an Executive Secretary: **NASA**
- The ILWS program shall have a Working Group comprised of one member each from contributing agencies
- Topical ILWS Task Groups will be established as necessary to support specific ILWS-WG projects/studies.



# Provisional Guidelines ILWS-WG Structure - II

- Meetings of the ILWS-WG to be held once per year or more often as necessary
- Each WG meeting to be chaired by the national representative of the host country  
(Washington: R.Fisher NASA; Nice: J.Y.Prado CNES)
- Meetings scheduled by consensus of membership of ILWS-WG



# Provisional Organization ILWS-WG



Facilitation

System Concept  
Coordination  
Prioritization  
Findings

Resources and  
Opportunities  
Data Systems



# ILWS Contacts



## Chair, ILWS Steering Committee:

Hermann J. Opgenoorth, ESA

E-mail: [hermann.opgenoorth@rssd.esa.int](mailto:hermann.opgenoorth@rssd.esa.int)

## Chair, ILWS Working Group:

Designated by agency hosting WG meeting.

in Nice 2003: J. Y. Prado, CNES

E-mail: [Jean-Yves.Prado@cnes.fr](mailto:Jean-Yves.Prado@cnes.fr)

## ILWS Executive Secretary:

David Sibeck, NASA

E-mail: [dsibeck@hq.nasa.gov](mailto:dsibeck@hq.nasa.gov)



# Why Do Science?

		<i>For Utility</i>	
		<i>No</i>	<i>Yes</i>
<i>For Understanding</i>	<i>Yes</i>	<b>Bohr</b>	<b>Pasteur</b>
	<i>No</i>		<b>Edison</b>

From Donald Stokes (Woodrow Wilson School for Public and International Affairs, Princeton University)

## *The Sun-Earth Connection -- Science in the Pasteur Mode*

- *How a star works*
- *How it affects humanity's home*
- *How to live with a star*



# The Sun-Earth Connected System

*Variable Star*

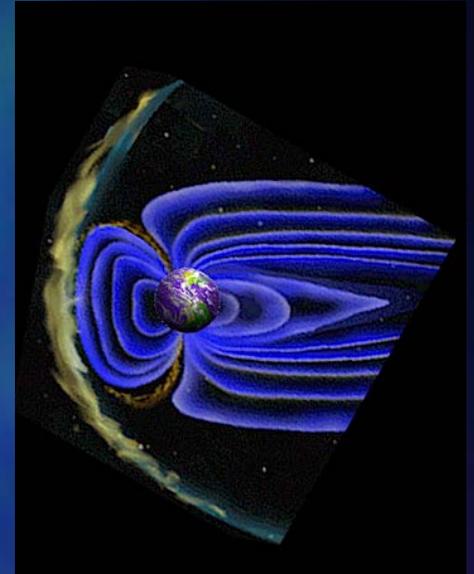


Varying

- Radiation
- Solar Wind
- Energetic Particles



*Planet*



## Questions:

- *How and why does the Sun vary?*
- *How does the Earth respond (and vary)?*
- *What are the impacts on humanity?*



# Main Themes of ILWS:

... to understand the governing processes of the connected Sun-Earth system...

... as an integrated entity.

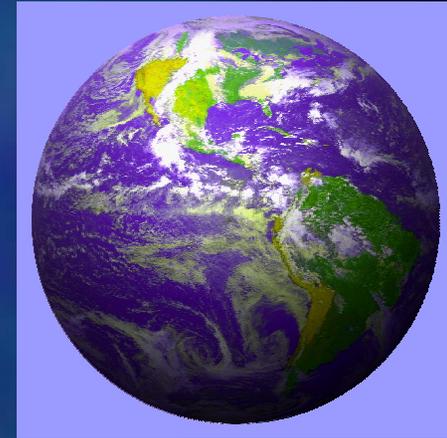
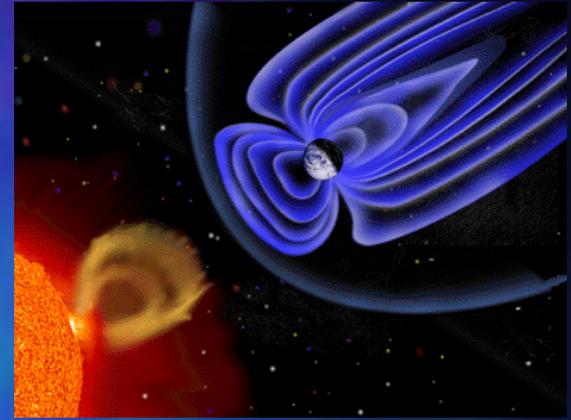
→ simultaneous and coordinated observations

→ at strategic locations in the entire system



# Why Do We Care?

- Solar Variability Affects Human Technology, Humans in Space, and the Terrestrial Climate.
- The Sphere of the Human Environment Continues to Expand Above and Beyond Our Planet.
  - Increasing dependence on space-based systems
  - Permanent presence of humans in Earth orbit and beyond



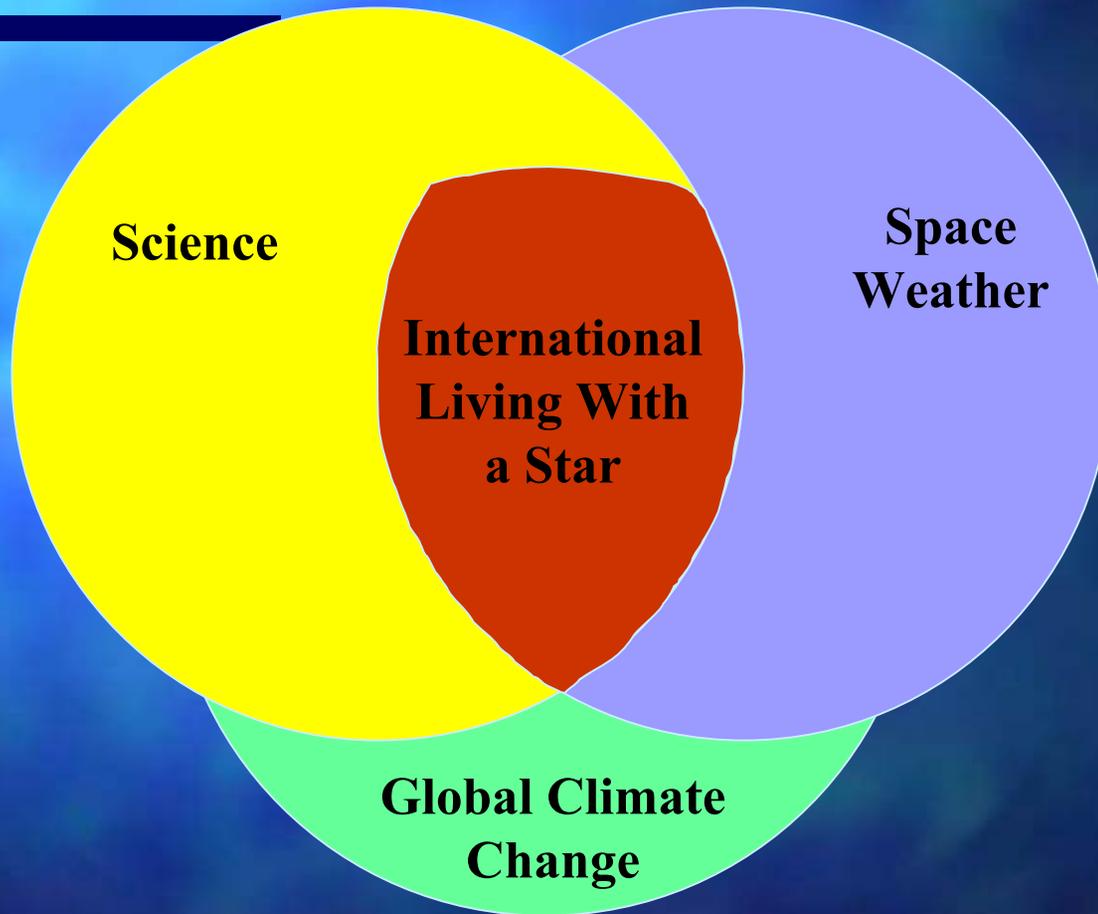
# What can we do about it?

*- Apply a systems approach.*

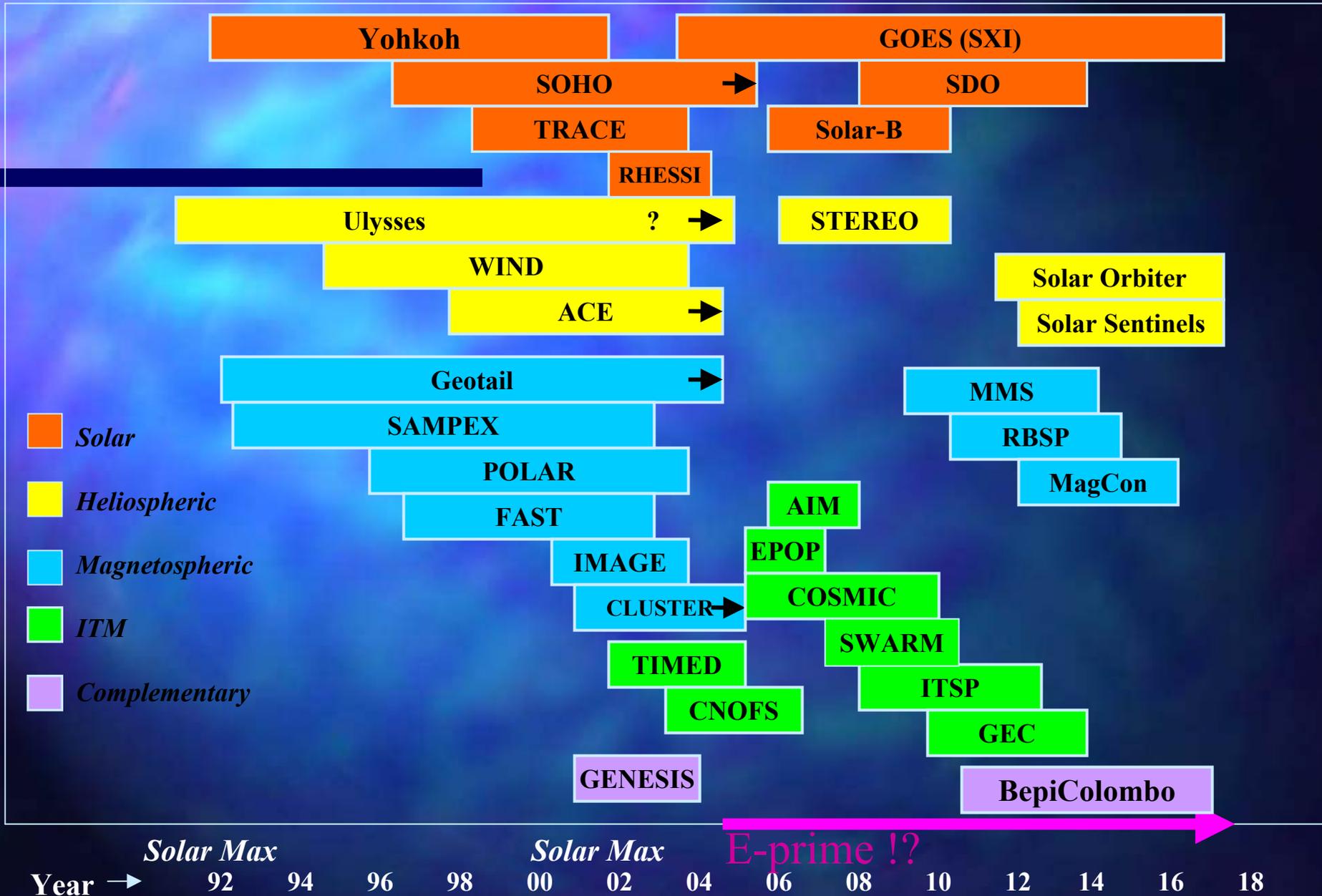
1. Quantify the physics, dynamics, and development of the Sun-Earth connected system through the entire range of conditions occurring in the 11 year Solar cycle.
  - Obtain improved measurements in the entire Sun-Earth system
  - Aim at a better understanding of the causal chain in Sun-Earth disturbances.
  - Understand the cause and variability of the solar cycle.  
*For long-range space weather forecasting & assessing solar role in climate change.*
  - Determine space environmental conditions vs location & time in the solar cycle.  
*Needed for design of systems to minimize sensitivity to space weather.*
2. Develop predictive models for the system which
  - demonstrate our understanding of Solar and Near-Planetary Space Physics.
  - and allow a reasonably accurate forecast and quantification of space weather.
3. Minimize impact of space weather on technology and astronauts:
  - Apply improved space weather predictions and accurate space environmental design specifications.
  - Fly low cost flight test beds for validation of rad-hard, rad-tolerant systems.



# International Living With A Star



# Present Solar-STP Missions & "First Order" ILWS Mission Chart



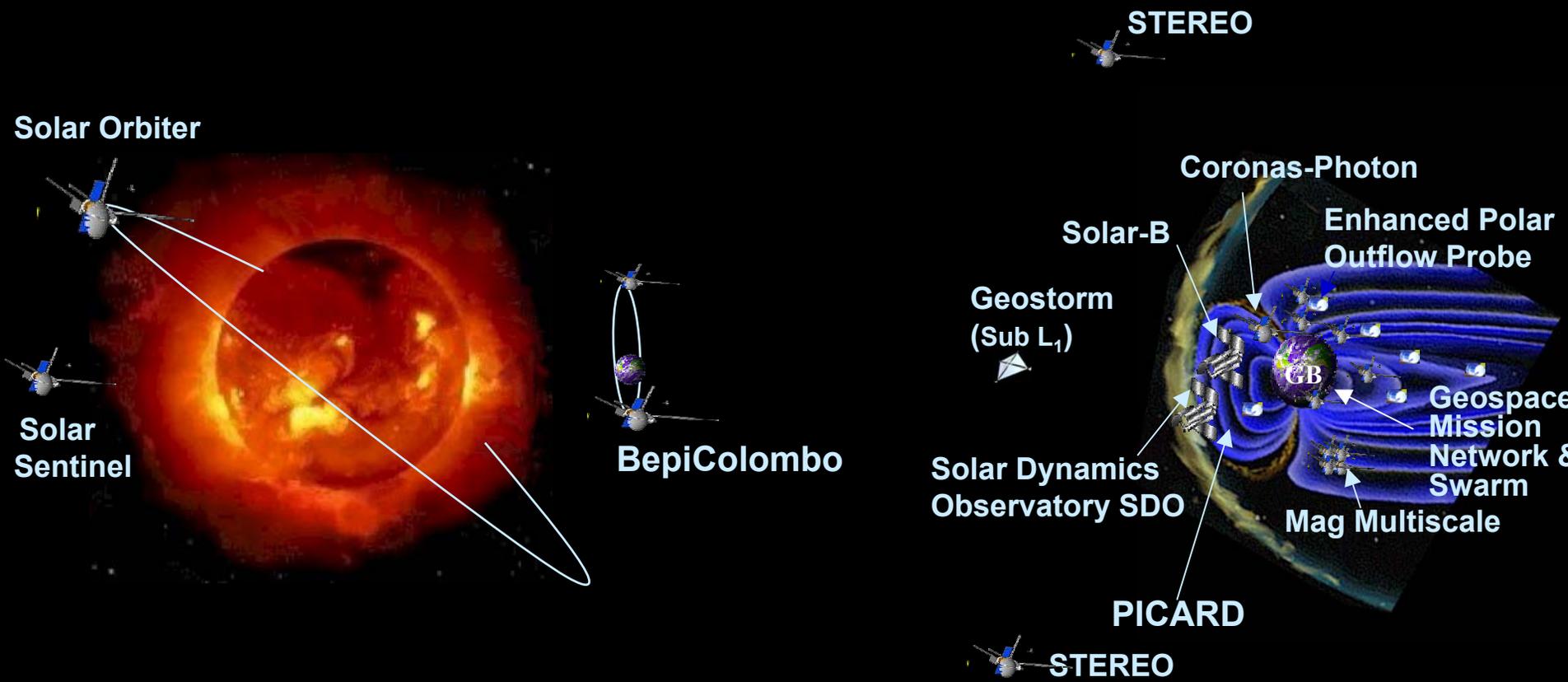
# International Living With a Star

## Some Candidate Missions



Ulysses

**Distributed network of spacecraft providing observations of Sun-Earth system.**



- **Solar-Heliospheric Network** observing Sun & tracking disturbances from Sun to Earth.
- **Geospace Mission Network** with constellations of smallsats in key regions of geospace.

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# Obvious Shortfalls in the Currently Planned ILWS Mission Fleet

- There is insufficient spacecraft coverage to sample simultaneously all critical regions & phenomena of the complex, time-varying geo-space environment
- The imaging of the upper terrestrial atmosphere and Earth's magnetosphere is severely limited in currently planned mission fleet (no UV, ENA etc imagers).
- Solar wind to be sampled at only a few points; no replacement for ACE (launched in 1997) at L1 in an approved (funded) program.
- Inadequate measurement of solar high energy phenomena (e.g. flares and energetic particles) currently planned for next solar maximum
- Gap in the measurement of Solar irradiance.

