Cubesat-based Science Missions for Space Weather Research: Plans for a new NSF Program

Therese Moretto Jorgensen
National Science Foundation

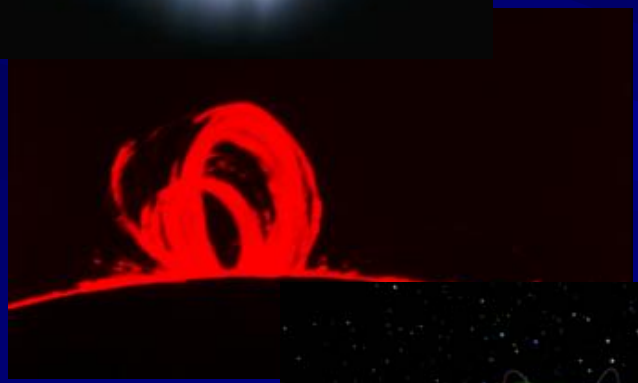
National Science Foundation (NSF)

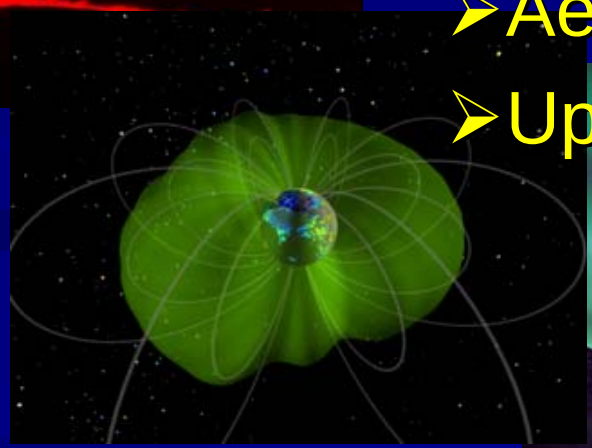
- Independent Agency of the Federal Government of the United States
- Established 1950 to promote and advance scientific progress in the United States
- Sponsors scientific research in most fields of science and engineering
  - operates no laboratories itself
  - does not conduct research itself.

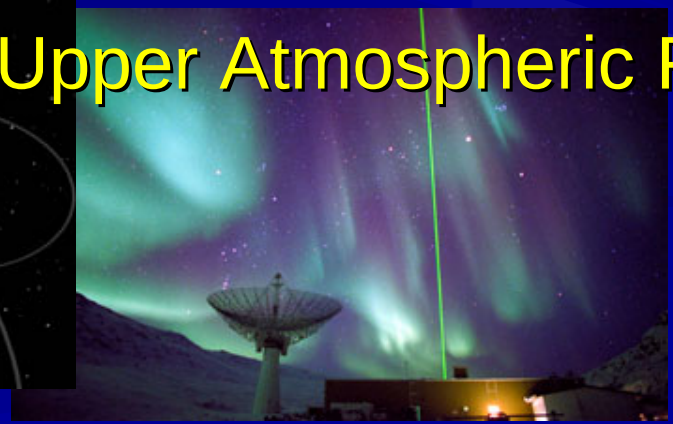
National Science Foundation also….

- Supports education and training at all levels
- Promotes public understanding of science, engineering and math
- Ensures a world-class science, engineering and technology workforce for the U.S.

Space Physics at NSF







- Div of Astronomical Sciences
  - Solar Astronomy
- Div Atmospheric Sciences
  - Solar Physics
  - Magnetospheric Physics
  - Aeronomy
  - Upper Atmospheric Facilities

Space Weather

"Space weather" refers to conditions on the sun and in the space environment that can influence the performance and reliability of space-borne, earth-based, and planetary technological systems and endanger human life or health.

- NSF supports basic research on space environment processes in support of the NSWP
- Lack of essential observations from space is a major limiting factor currently in space weather research.
- Investigating the use of small satellites to address space weather goals was a key recommendation in a recent assessment of the NSWP (Lanzerotti panel)

The NSF Small Satellite Workshop

- Background
  - NSF is considering establishing a program for small satellites for space weather research
- May 15-17, 2007 at George Mason University, VA
- Purpose
  - To explore the possibilities and benefits of utilizing small satellite missions to provide essential measurements for space weather and atmospheric research
- Participation
  - About 150 participants from academia, government (DOD, NASA, NSF), and private aerospace industry

virbo.org/wiki/index.php/SSW

Some Main Findings

- It is feasible
  - Scientific satellite missions in the $1M-$10M range (incl. launch) seem possible
- It will advance space weather research
  - Missions can help fill important observational gaps
  - Will inspire the development of new experimental methods and technology
- It has Educational benefits
  - Crucial role in training the next generation of experimental space scientists and aerospace engineers.
- The main obstacle is access to space!
  - Securing regular, low-cost access to space for small scientific payloads is non-trivial

Developing a NSF Satellite Program Supporting Space Weather

- The goal: A continual program of $5M - $10M per year
  - To advance space weather and atmospheric research and education through development, building, launch, operation, and data analysis of small scientific satellite missions
- First steps
  - Establish partnerships with other government agencies and private industry to secure a series of regular, low-cost launches
  - Construct a 5 to 10 year program and conduct annual proposal competitions consistent with programmatic plans and space weather goals

Start-up Program Plans

- Cube-sat based science missions
- Launching 2-3 P-PODs per year
  - Starting late 2009
- 3-6 new science missions per year
  - Regular research grants
  - 3-5 years, ~$300k - $900k Total Cost
  - Includes Satellite design, building, and testing, operations, and data distribution and analysis
  - Selection based on potential science return
    -- NOT pure technology demonstration
  - Training and student participation REQUIRED

Potential Budget Scenario

	FY08	FY09	FY10	FY11
1st missions	$900k	$900k	$900k	
1st launch		$700k		
2nd missions		$900k	$900k	$900k
2nd launch			$700k	
3rd missions			$900k	$900k
3rd launch				$700k
4th missions				$900k
Etc.				
TOTAL	**$900k**	**$2,500k**	**$3,400k**	**$3,400k**

- This Assumes:
  - One set of Science missions per year: $900k
  - Integration and launch of 3 P-PODs: $700k
- Disclaimer: these are not approved numbers!

Getting Ready

- On my side
  - Draft Solicitation; Hopefully out Fall 2007; Deadline for proposals early 2008
  - Secure agreements for integration and launches
- On your side
  - Develop mission ideas
  - Team up! Establish appropriate collaborations
- Together
  - This is totally new for NSF!
  - Your help with establishing an efficient and successful process is greatly appreciated