Science Mission Directorate

NASA view of the CCMC

Charles P Holmes

Sun-Solar System Connections Missions
Supporting Future Exploration

FLIGHT PROGRAM

1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020 2022 2024

Development
Formulation
Under Study

STP Program
Solar -B (with Japan)

STEREO Nominal mission

LWS Program

SDO Nominal mission + 5 yr Extended mission

Ionospheric-Thermospheric Storm Probe mission

Radiation Belt Storm Probe mission

Heliospheric Sentinel Mission
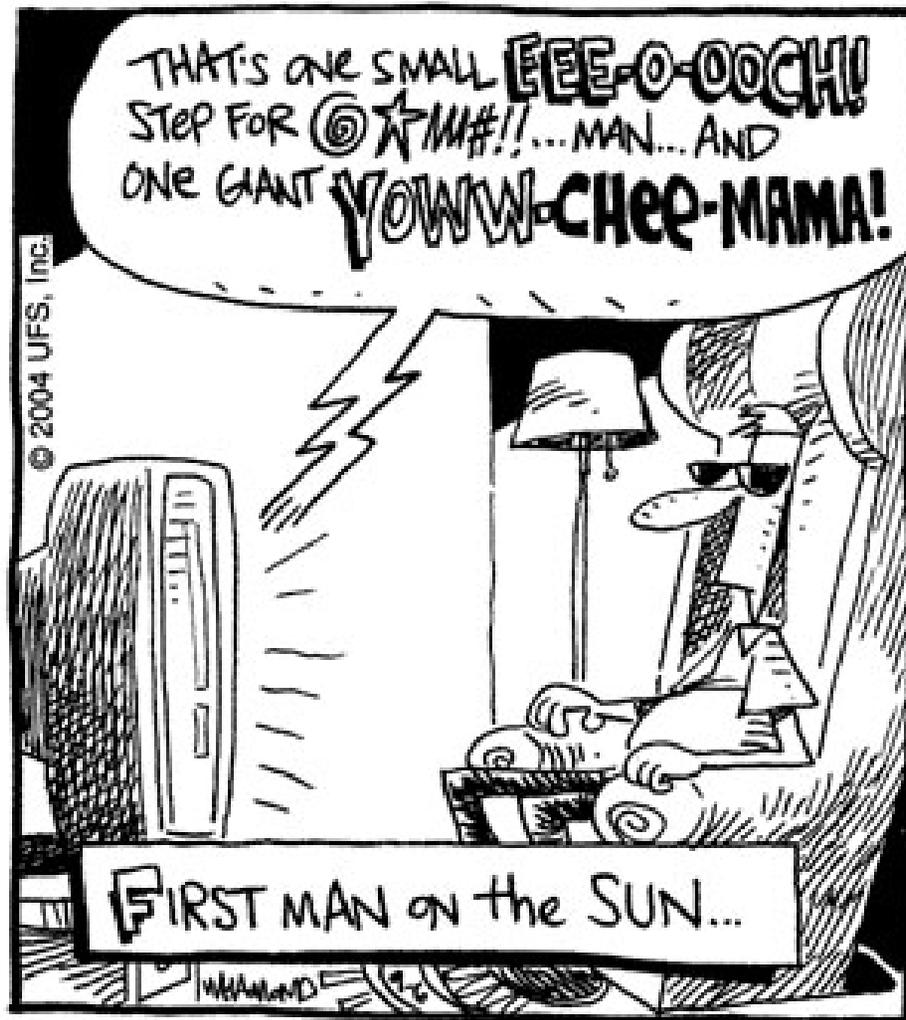
Solar Probe Mission (Augmentation under study)

From the first
in-situ
space weather
reporter!

From the National Space Weather Program Implementation Plan, 2nd Ed.

- The mission of the CCMC is to provide a computing facility to enable, support, and perform the research for next generation space science and space weather models, preparing them for transition to operations through the RPCs.

QuickTime™ and a
TIFF (LZW) decompressor
are needed to see this picture.

The CCMC's goals are to:

- Develop with the community and execute next generation space research models, aiming specifically at space weather needs
- Integrate existing models to cover the necessary range of physical scales
- Provide computational infrastructure for space weather modeling
- Prepare models for transition to rapid prototyping centers
- Make research models developed at CCMC as well as their output available to all in the community
- Support of community research
  - through execution of model runs on request
  - through preparation of visualization and analysis tools
  - through source code dissemination and model output availability
  - through general community-based development
- Perform basic research
  - using existing and newly merged models
  - for the development of new models
  - in support of space weather goals

CCMC goals [cont'd]

In addition to meeting these goals, the CCMC will provide additional benefits such as enhancing scientific understanding, providing broad access to research models, providing effective use of mission data, enabling cross-disciplinary science, and aiding mission conception and design.

Sun-Solar System Connection Roadmap
Knowledge for Exploration

Objective: **Explore the Sun-Earth system to understand the Sun and its effects on Earth, the solar system, the space environmental conditions that will be experienced by human explorers, and demonstrate technologies that can improve future operational systems**

Opening the Frontier to Space Environment Prediction

Understand the fundamental physical processes of the space environment – from the Sun to Earth, to other planets, an d beyond to the interstellar medium.

Understanding the Nature of Our Home in Space

Understand how society, technological systems, and the habitability of planets are affected by the variable space environment.

Safeguarding Our Outbound Journey

Maximize the productivity and safety of human and robotic explorers by developing predictive capability for the extreme and dynamic conditions in space

From the 2005 S³C Roadmap:

- NASA must also invest in analysis infrastructures that support computing and data analysis efforts. This is a critical element in the symbiotic advance of scientific understanding through mission design: scientists use data from existing missions to improve theories and models, which then suggest measurements for the next mission. Large-scale numerical calculations, such as the temporal evolution of fundamental equations in three dimensions, require massive supercomputers. … A strong computing structure is also needed to support data analysis and data assimilation, especially for increasingly large and complex data and modeling structures.

- **Fortunately**, much of this supporting infrastructure is in place, as evidenced by … the Columbia supercomputing project, the Community Coordinated Modeling Center (CCMC), and NASA's Applied Information Systems Research Program, …

From the 2005 Roadmap (cont'd)

- As we continue to explore Sun-Solar System connections, the requirement to effectively model the vast systems we study using sparsely sampled observations becomes more critical. Remote space weather predictive capabilities may even be required for explorers far from Earth. In many missions … modeling will be a critical element of the mission itself, while other modeling efforts will be required to assimilate the data collected by multiple missions into coherent models.

- The necessary groundwork for these activities has already begun … The goal of producing integrated models, and software frameworks that link these models, is also being addressed, with organizations such as …CCMC,…CISM) and CSEM.

From Jim Slavin (Oct 4, 2005)

- CCMC makes a number of important contributions to NASA and its mission:
  - as space weather forecast system pathfinder,
  - a conduit for enhanced communication and cross-pollination between the science and operations communities,
  - a leader in the development of new space environment simulations and
  - an on-ramp that provides the solar and space physics community access to state-of-the-art space simulations to support their basic research.

The NASA view of the CCMC?

- Good show!

- Carry on!