HAO: Forward

“Building Capability - Enabling Community”

Scott W. McIntosh
Director, High Altitude Observatory
HAO studies the processes that drive the ongoing relationship between the Sun and the Earth from minutes to centuries. Combining state-of-the-art observational methods and numerical simulations HAO is working to improve forecasts of solar activity across scales that can have major societal impact.
Our “Helio-Geospace” Community

HAO’s focuses on the Boundaries of the Sun-Earth System
HAO is one of SEVEN NCAR Labs
HAO’s Present Structure

Lead Administrator
Joanne Graham

Administrative “A”-Team
Kim Nesnadny

Computer System Management Team (CSMT)

Director
Scott McIntosh

Assistant Director
Steve Tomczyk

Mauna Loa Solar Observatory (MLSO)
Joan Burkepile

Instrumentation Group
Scott Sewell

Long-term Solar Variability (LSV)
Sarah Gibson

Atmosphere Ionosphere Magnetosphere (AIM)
Mike Wiltberger

Solar Transients and Space Weather (STSW)
Roberto Casini

Instrumentation Group
Scott Sewell
As we move forward it is imperative that…

**Build strong, permanent scientific ties to our sister labs within NCAR.**

**Build strong, permanent and multi-way ties to the national and international community.**

…we must build capabilities that both challenge our scientific understanding and help these groups reach their own goals.

…we must be relevant to the tax-payer and our stakeholders.
2016 - 2020 Strategic Plan

We have started developing our 2016 - 2021 strategic plan. We will align strongly with the 2015-2020 NCAR strategic plan and develop activities that foster collaboration with other NCAR Laboratories and the broader community. We are working on a plan that will help push scientific frontiers that benefit the community.

March 16 - April 21: Focus area meetings to develop challenges for the working groups.
April 21, 2015: Open Discussion of working group challenges with HAO staff.
May 11, 2015: Staff Retreat
June 14, 2015: Discussion of draft Goals with NSF/Geospace PR Group.
August 3, 2015: Strategic Goals Write-ups to be collected from writing teams.
August 15, 2015: Plan Writing group convened.
September 1-3, 2015: 75th Anniversary Celebration.
October 5 - 7, 2015: Discuss draft plan, and potential implantation steps with HAO’s External Advisory Committee at in-person meeting.
October 16 - 23: Anticipated Draft plan completion. Distribution to NCAR directorate, NSF/AGS, GeoSpace section staff for comment.
October 30, 2015: Community comment period begins.
November 13, 2015: Community comment period ends.
December 1, 2015: Plan completion and publication online.
January 1, 2016: New plan is in effect.
**Challenge I**: Improve understanding and forecasting of space weather hazards and their impacts on the Earth, people, and society.

**Challenge II**: Improve understanding and projection of solar contributions to geospace and atmospheric system variability on regional and global scales.
Building Capability

Building capability to understand space weather origins across timescales through the combination of comprehensive observation of the magnetized outer solar atmosphere and state-of-the-art modeling.

Building capability to understand the complex spectro-polarimetric signals of the outer solar atmosphere.

Building capability to understand the bottom-up and top-down variability in the thermosphere/ionospheric nexus of space weather across timescales.
Organizational Structure to Attack Challenges

Lead Administrator
Joanne Graham

Director
Scott McIntosh

Assistant Director
Steve Tomczyk

Instrumentation Group
Mauna Loa Solar Observatory (MLSO)

Administrative “A”-Team
Computer System Management Team (CSMT)

Space Weather

Space Climate

MLSO [CoSMO]
CSAC
Cross-Disciplinary Focused Science Teams
WACCM-X

Themes

Staff/Community Strategic Working Groups
Building Capability

Models are needed to help interpret the increasingly complex observations acquired by our community (e.g. HAO/ChroMag, NSO/DKIST).

State-of-the-art MHD simulations, built on Rempel’s sunspot simulation heritage, are being extended into the Sun’s outer atmosphere.

Lead to improved understanding of the evolution of the outer solar atmosphere and its magnetic field that at the heart of space weather and space-climate studies.

- Refine strategies for extraction of information about outer atmospheric magnetism.
- Drivers of atmospheric heating, and solar wind acceleration
- Explore constituents of total and spectral solar solar irradiance variation.
Develop parallel observing and modeling capabilities to enable advances in understanding the drivers of impulsive solar storms.

Combining observations from MLSO [KCor & CoMP], other ground- and space-based observatories, with numerical schemes of magnetic flux emergence and advanced methods of coronal “forward” modeling our goal is to improve knowledge of the critical initialization and early flight of coronal mass ejections and solar storms.
Thinking Beyond

Improve understanding and forecast capability for the ionospheric/thermospheric system.
Building Capability

Data Assimilation

ACOM

CGD

CESM

WACCM

WACCM-X

RAL

EOL

CISL

MMM

NCAR UCAR HAO 75 years

sun • earth • connections
Thinking Bigger: Geospace

What comes after WACCM-X?

Coupled Whole Geospace Model?

Constellation Sampling and Data Assimilation?
Imagine a “Solar Meteorology Mission” to image and capture the 360 degree hemispheric environment!

Are flares intrinsically unpredictable?

★ Progressions of 22-year activity bands frame the 11-yr solar cycle.

★ The bands in each hemisphere exhibit a strong instability - almost of same magnitude as decadal variability.

★ Flares/CMEs Cluster
  • In Latitude
  • In Time

★ Majority of space weather events are related to quasi-annual surges of solar magnetism. Not isolated events, but forced.

★ Evidence of significant “surges” in the eruptive, radiative, and particulate records.

★ Flares and CMEs are connected to the Sun’s global weather patterns - we are limited by our viewing perspective
Building Capability

ECLIPSE17 Field Campaign

Stabilized imaging platform for the NCAR GV that will be available to the community for later deployments.
HAO - Broad Impact

• The NSF/REU Program in Boulder
  ★ Administered jointly by LASP/Univ. Colorado and HAO.
  ★ 18 undergraduate students – 10 women - in FY2015: 5 at HAO.
  ★ 41% women, 10% racial/ethnic minorities over history of program.

• HAO/Univ. of Colorado BOLD Program
  (BOLD = Broadening Opportunity through Leadership and Diversity)
  ★ 3 undergraduate students in HAO all women in FY2015
  ★ 71% women, 29% racial/ethnic minorities over history of program.

• Expanding your Horizons
  ★ STEM workshop targeted at middle-school girls
  ★ Part of a national network serving 25,000 girls each year
  ★ Boulder branch: 320 students and 62 adults served in FY2015
  ★ 100% women, 40-50% racial/ethnic minorities

• CISM Space Weather Summer School
  ★ 28 graduate students served in FY2015, >90 in last three years
  ★ 30% women over history of program.

• More!
  ★ The HAO Visitor program and Newkirk Fellowships
    • 8 postdocs and 4 graduate students in FY2015 (25% women)
  ★ Undergraduate and graduate teaching
  ★ Sun-Earth Connection Exhibit at NCAR Mesa Laboratory
  ★ Super Science Saturday
  ★ PhD & Masters Thesis committees, mentoring
  ★ Primary and secondary School visits
  ★ 2017 Eclipse “Megamovie” Citizen-Science Project
To Conclude

We Will.....

★ Continue to explore the origins and instabilities of solar magnetism.
★ Continue to develop CoSMO and push for next generation observations to improve space weather forecast skill.
★ Develop mechanisms to understand the magnetic signals from our star throughout the atmosphere.
★ Continue to develop WACCM-X.
★ Develop assimilative strategies for solar and terrestrial observations to improve model forecast skill.
★ We will actively seek partnerships to integrate our science with the broader community.
★ We will engage the public and advocate for the community.
Thanks You!

The UCAR President’s Office
The NCAR Director’s Office

HAO’s Staff
The Members of the Boulder Solar Alliance

Our Keynote Speakers: Tom Bogdan, John Grunsfeld, Sue Lepri & Lara Waldrop

Congressman Ed Perlmutter (& Staff)

The UCAR Communications Team
The UCAR Archive Team
UCAR Multimedia Services & HAO’s CSMT
The UCAR Events Team
Thanks

Joan Burkepile
Sheryl Shapiro
Andy Stanger
Greg Kopp
Wendy Hawkins
“Tito” Salas
Bob MacQueen
Doug Duncan
Rebecca Centeno-Elliott
Don Kolinski
Alice Lecinski
Joanne Graham
Greg Card
Building Community

How do we build community?

How do we set goals?

Is the current mechanism effective?

How do we bring the community together?

Interdisciplinary System-Science Focus

Higher Frequency “State of the Field” Symposium
Inform Decadal Survey Development

Inform/Involve Agency Leaders
Inform/Involve Policy Makers
“The Outer Limits - The Borderland” (1963)