State of the Space

Weather Prediction Center 2009

Thomas J Bogdan

Space Weather Program Manager
Space Weather Prediction Center Director

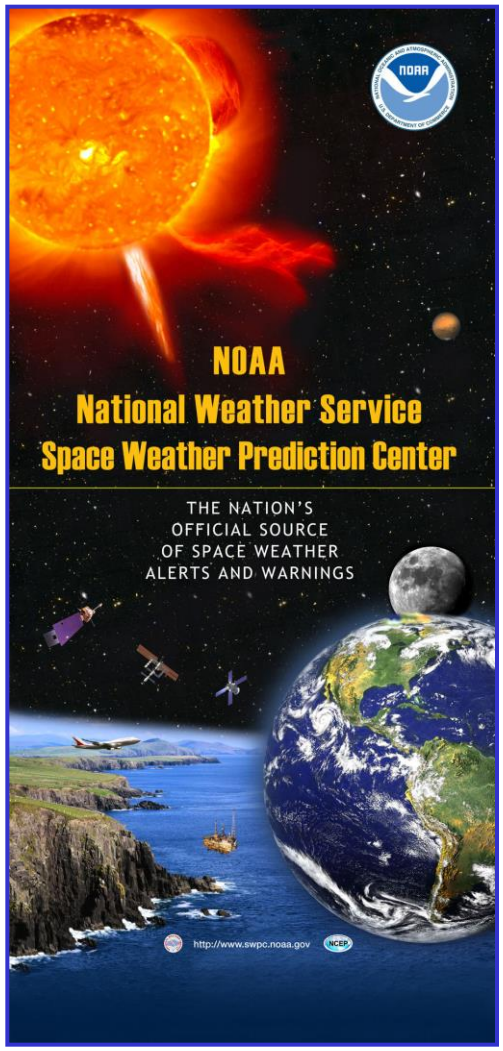
Mission

To deliver space weather products and services that meet the evolving needs of the nation

Vision

A nation prepared to mitigate the effects of space weather through the understanding and use of actionable alerts, forecasts, and data products

Safeguarding Our Nation's Advanced Technologies



Our Corporate Values

- Quality service and support to our customers and partners
- A diverse, innovative, and empowered workforce
- A science based approach to meeting our mission and goals
- A secure and robust information technology infrastructure
- Open exchange of data, information, and ideas

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Timeline of Key Events

- Moved from OAR to NWS, January 2005
- Bogdan becomes Director, May 2006
- First Space Weather Enterprise Forum, April 2007
- SEC to SWPC name change, July 2007
- NWSEO Steward named, July 2007
- Reorganization in place, October 2007
- Reorganization official, February 2008
- Last Ops Spec converted to forecaster, March 2008
- First Strategic Plan Completed, June 2008
- This review, June 2009

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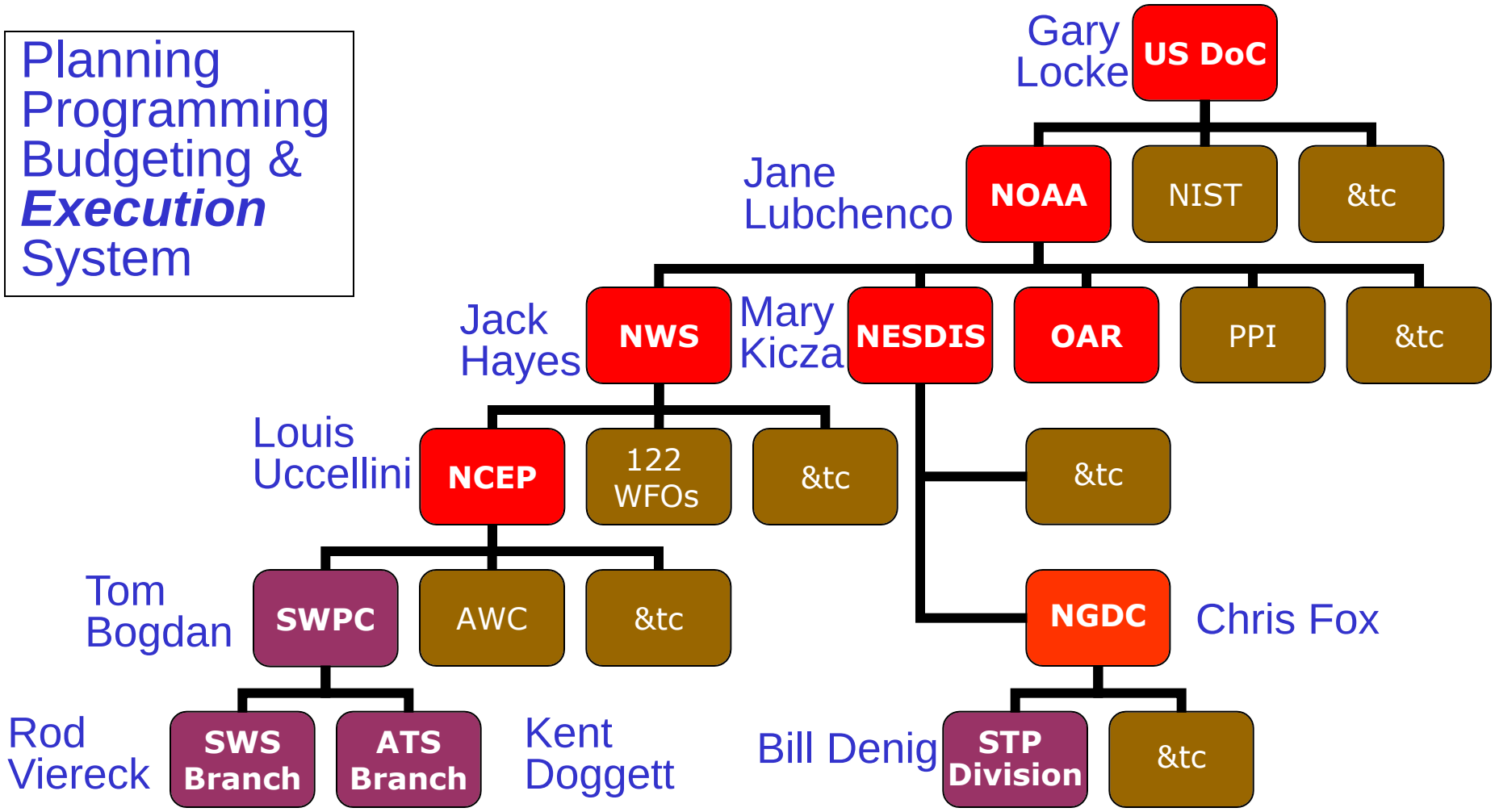
PPBES 101

- Planning, Programming, Budgeting & Execution System
- Based on 5-year “planning cycles”. i.e.,
  - FY2009-2011 We are EXECUTING this one now
  - FY2010-2014 This one is waiting on CONGRESSIONAL ACTION
  - FY2011-2015 This one is coming out of the NOAA BUDGETING office
  - FY2012-2016 And this one is under active NOAA PLANNING
- Brought to NOAA by VADM Lautenbacher from DoD
- This is formally defined as a “MATRIX MANAGEMENT SYSTEM”, meaning
  - (Usually) Different people PLAN, PROGRAM from those who EXECUTE
  - But, the BUDGET people are largely the same and different from the rest

Execution Organization

Planning
Programming
Budgeting &
Execution
System



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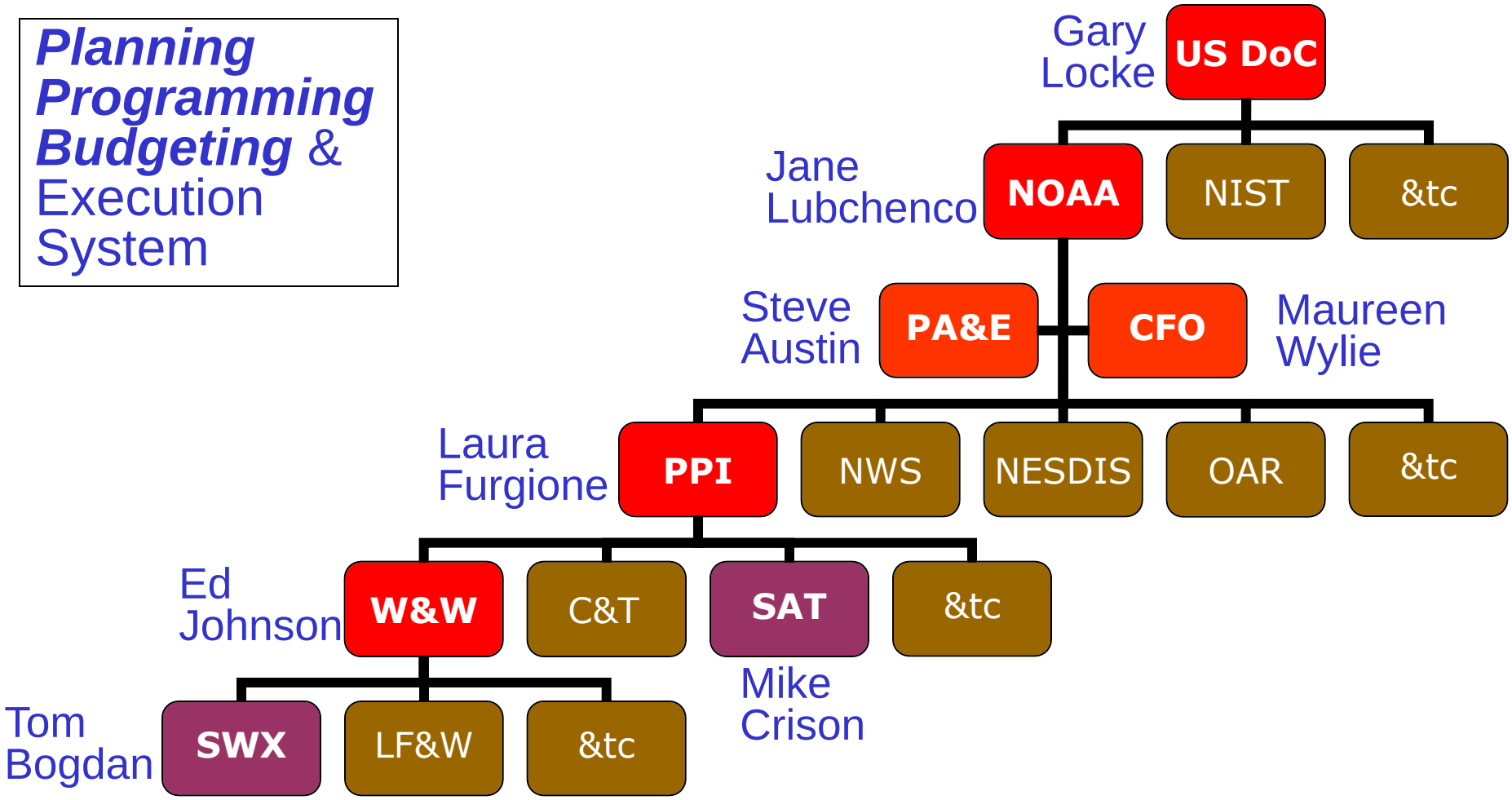
Planning, Programming, and Budgeting Organization

Planning
Programming
Budgeting &
Execution
System



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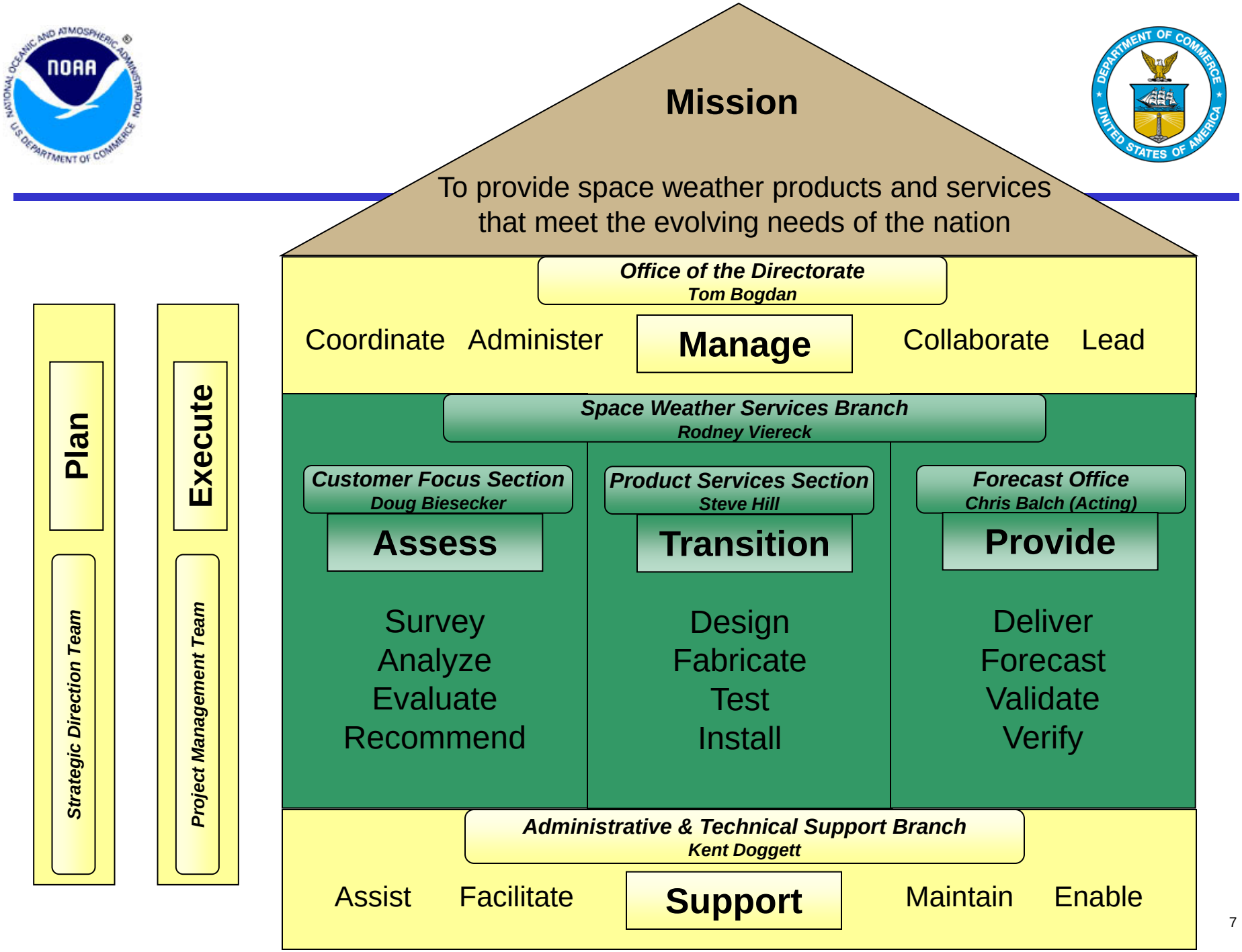
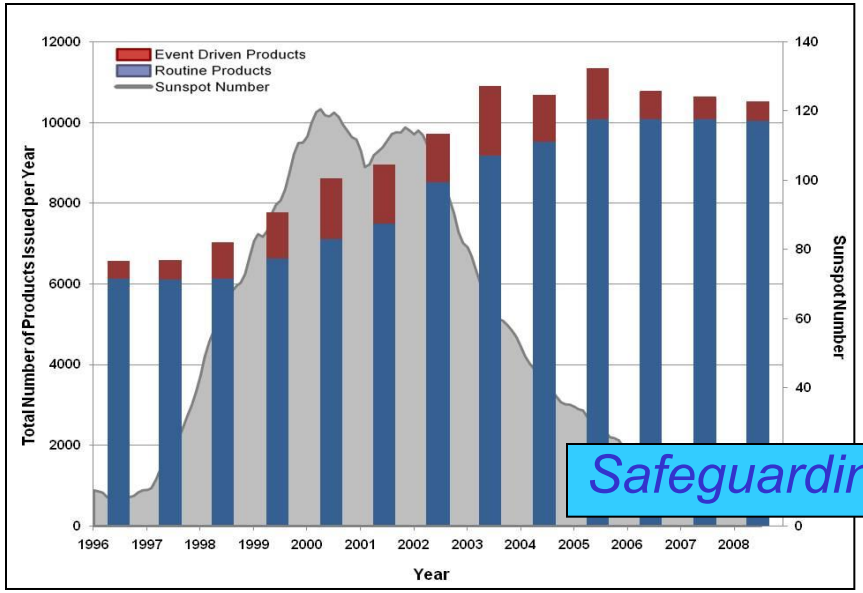

Mission
To provide space weather products and services that meet the evolving needs of the nation
Office of the Directorate
Tom Bogdan
Coordinate
Administer
Manage
Collaborate
Lead
Space Weather Services Branch
Rodney Viereck
Customer Focus Section
Doug Biesecker
Assess
Survey
Analyze
Evaluate
Recommend
Product Services Section
Steve Hill
Transition
Design
Fabricate
Test
Install
Forecast Office
Chris Balch (Acting)
Provide
Deliver
Forecast
Validate
Verify
Administrative & Technical Support Branch
Kent Doggett
Assist
Facilitate
Support
Maintain
Enable
Plan
Strategic Direction Team
Execute
Project Management Team

New Customers



USSTRATCOM	Inmarsat	FEMA	Boeing	FAA
White House Communications Agency	L-3 Communications	Florida Division of Emergency Mgnt.	British Petroleum America	Bonneville Power Administration
Washington St. Dept of Transportation	Caterpillar, Inc.	Alaskan Airlines	United Launch Alliance	Salem and Hope Creek Nuclear Stations

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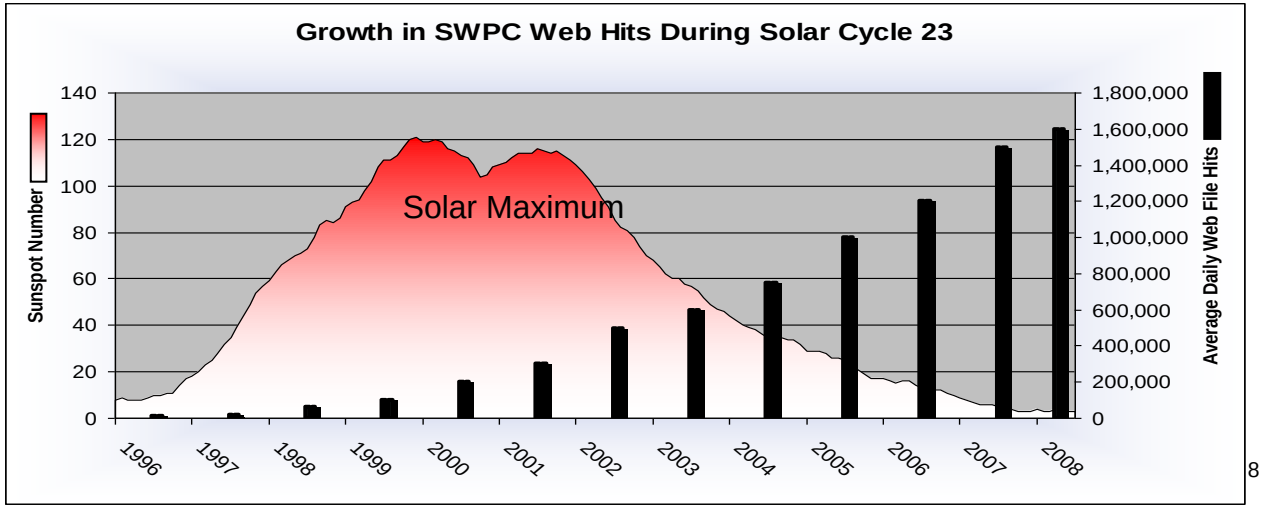
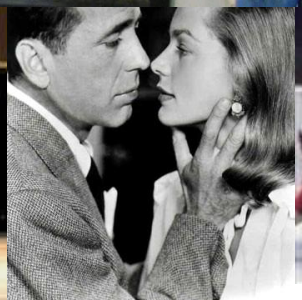


Some Great Teams

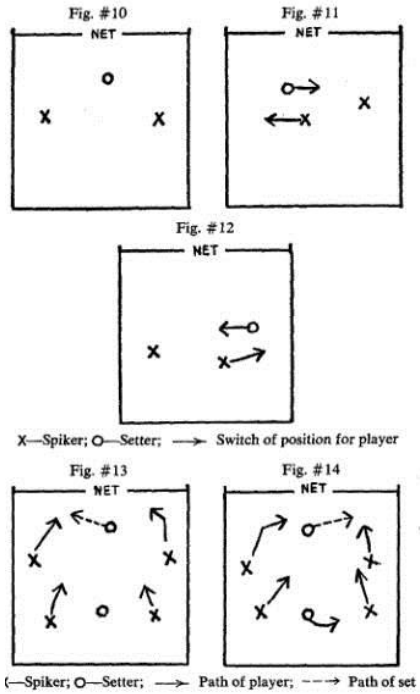




My Personal Values

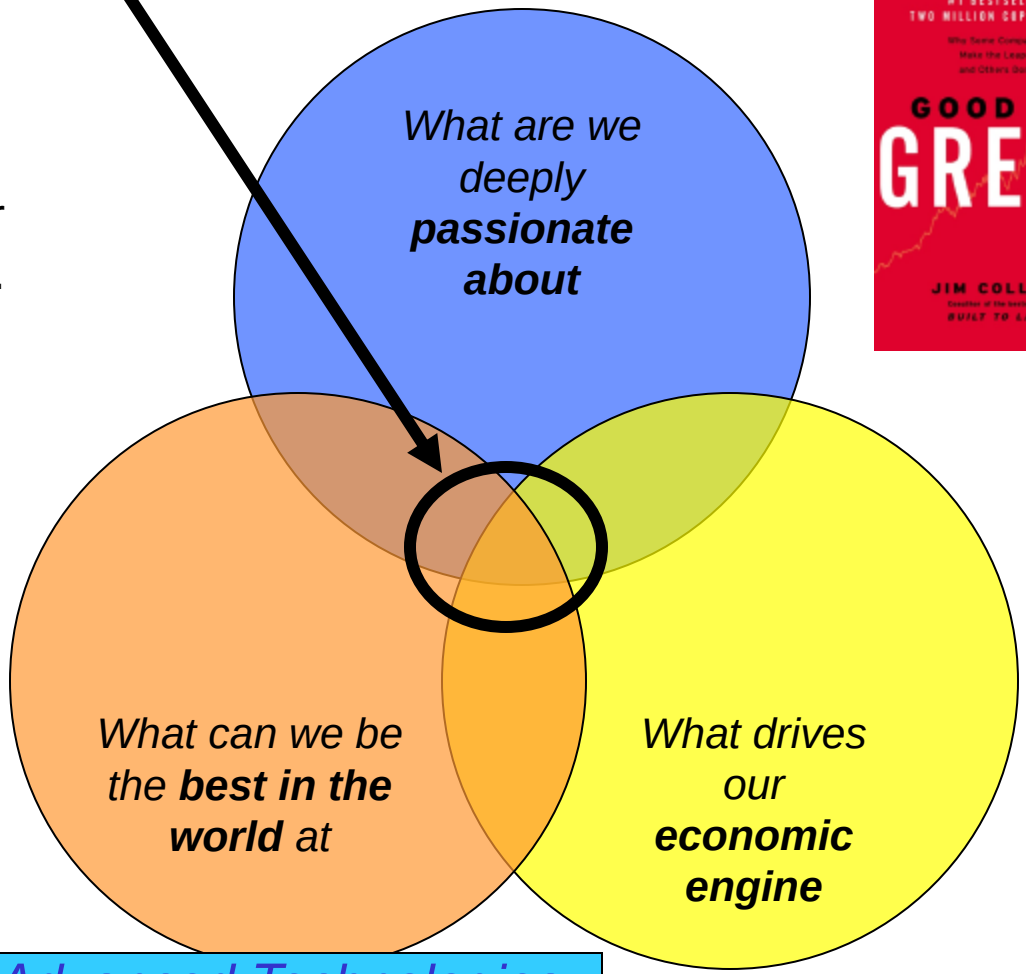
- Always do your best
- Be impeccable with your word
- Do not make assumptions
- Do not take anything personally
- Always be a team player first

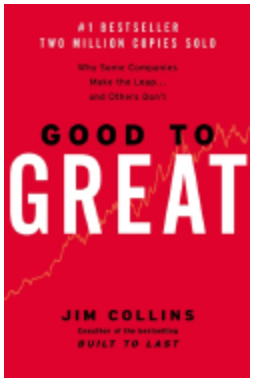


What's a Hedgehog Concept?

The **Fox** knows many things, but the hedgehog knows one big thing. The fox is a cunning creature, able to devise a myriad of complex strategies for sneak attacks on the hedgehog.

Hedgehogs, on the other hand, simplify a complex world into a single organizing idea, a basic principle or concept that unifies everything. For a hedgehog, *anything that does not somehow relate to the hedgehog idea has no relevance*.

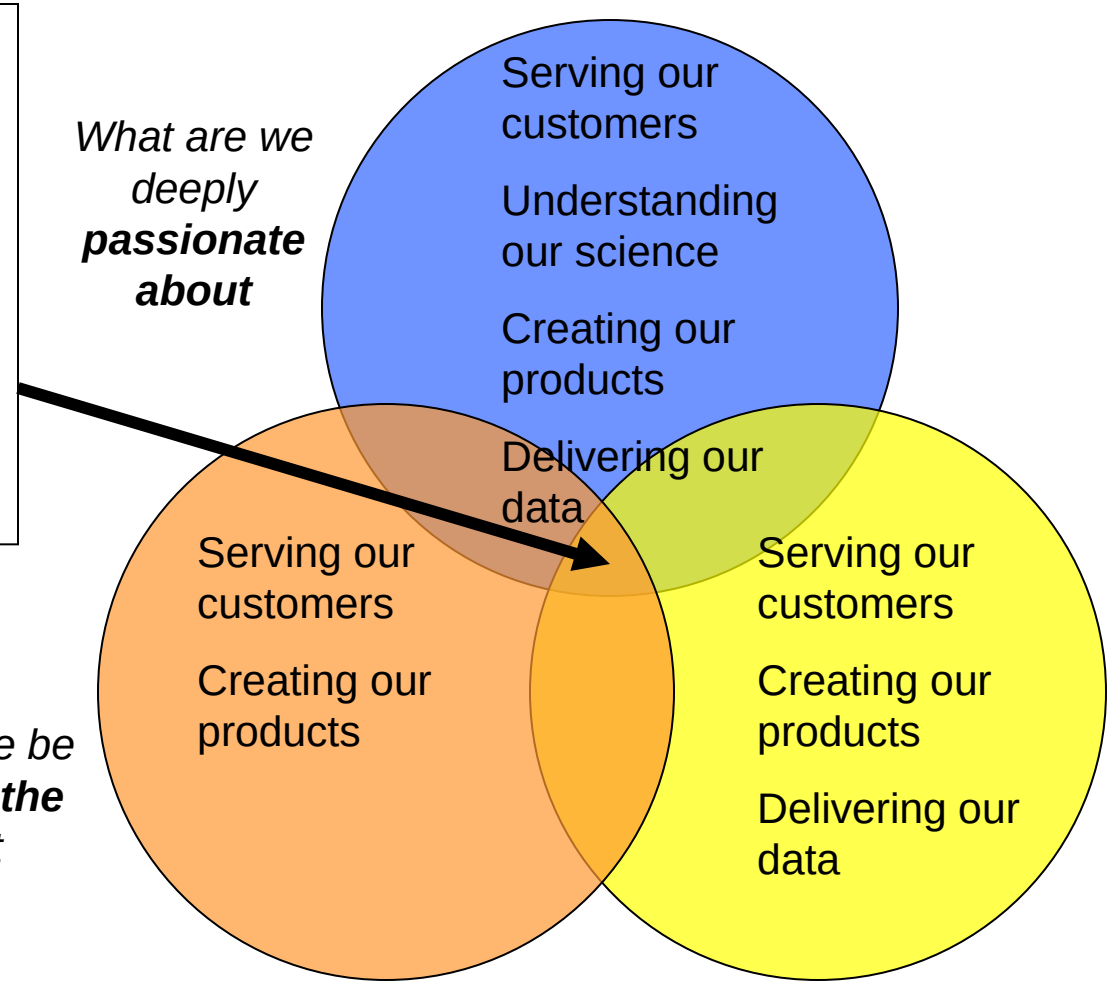




Safeguarding Our Nation's Advanced Technologies

SWx's Hedgehog Concept

…is to improve our customer service by creating new space weather PREDICTION models and forecast capabilities!



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SWx's Hedgehog Concept

…is to improve our customer service by creating new space weather PREDICTION models and forecast capabilities!

- Observations & Data
- Space environment awareness
- Transition to operations of numerical space weather prediction models for prognostic guidance [R2O]
- Model validation & verification [V+V]
- Forecast and Product creation & delivery [FORECASTS]
- Customer feedback to SWPC
- Operations to research feedback [O2R]
- Data stewardship, archive and access [A&A]
- Targeted research and development [R&D]

Safeguarding Our Nation's Advanced Technologies

	Today	Tomorrow
• Observations & Data	SWPC	NESDIS OSDPD, OSO, NGDC NWS OOS
•Transition to operations of numerical space weather prediction models for prognostic guidance [R2O]	SWPC	NWS/NCEP SWPC, EMC, NCO
• Space environment awareness	SWPC	NWS/NCEP SWPC
•Model validation & verification [V+V]	SWPC	NWS/NCEP SWPC
• Forecast and Product creation & delivery [FORECASTS]	SWPC	NWS/NCEP SWPC, NCO
• Customer feedback to SWPC	SWPC	NWS/NCEP SWPC
• Operations to research feedback [O2R]	SWPC	NWS/NCEP SWPC
• Data stewardship, archive and access [A&A]	SWPC NESDIS NGDC	NESDIS NGDC
• Targeted research and development [R&D]	OAR CIRES SWPC	OAR CIRES OAR ESRL

Budget Numbers

	FY 05	FY 06	FY 07	FY 08	FY 09	FY 10
President's Request	$7.5M	$7.2M	$7.3M	$6.1M	$6.4M	$9.4M
House Mark	$7.5M	$7.2M	$5.0M	$6.1M		
Senate Mark	$5.0M	$7.0M	$7.3M	$6.1M		
Enacted	$6.8M	$3.9M	$3.9M	$6.1M	$6.4M	
Actual		$5.9M	$7.1M	$6.4M	$7.6M	

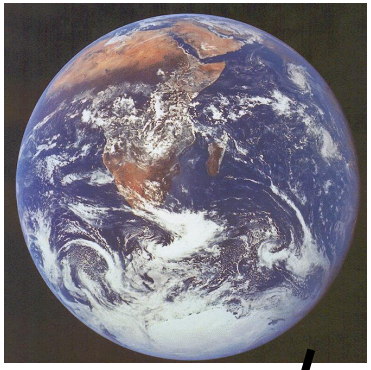
Oceanic & Atmospheric Research

National Weather Service

Safeguarding Our Nation's Advanced Technologies

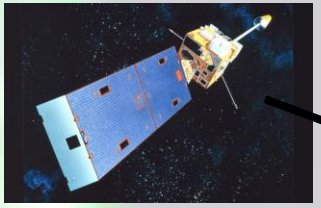
L1 Solar Wind Monitor Update: CSESMO

OFCM led Committee for Space Environment Sensor Mitigation Options (CSESMO) to provide recommendations to OSTP and OMB in September 2009 (FY11)



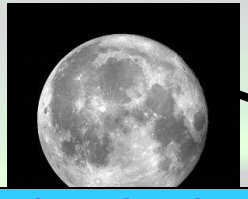
EARTH

GOES 11/12/13 IN GEOSTATIONARY ORBIT

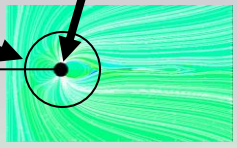


ABOUT 1 % OF THE DISTANCE FROM THE EARTH TO THE SUN, ACE IS OUR SPACE WEATHER SENTINEL.

MOON



EARTH'S MAGNETOSPHERE



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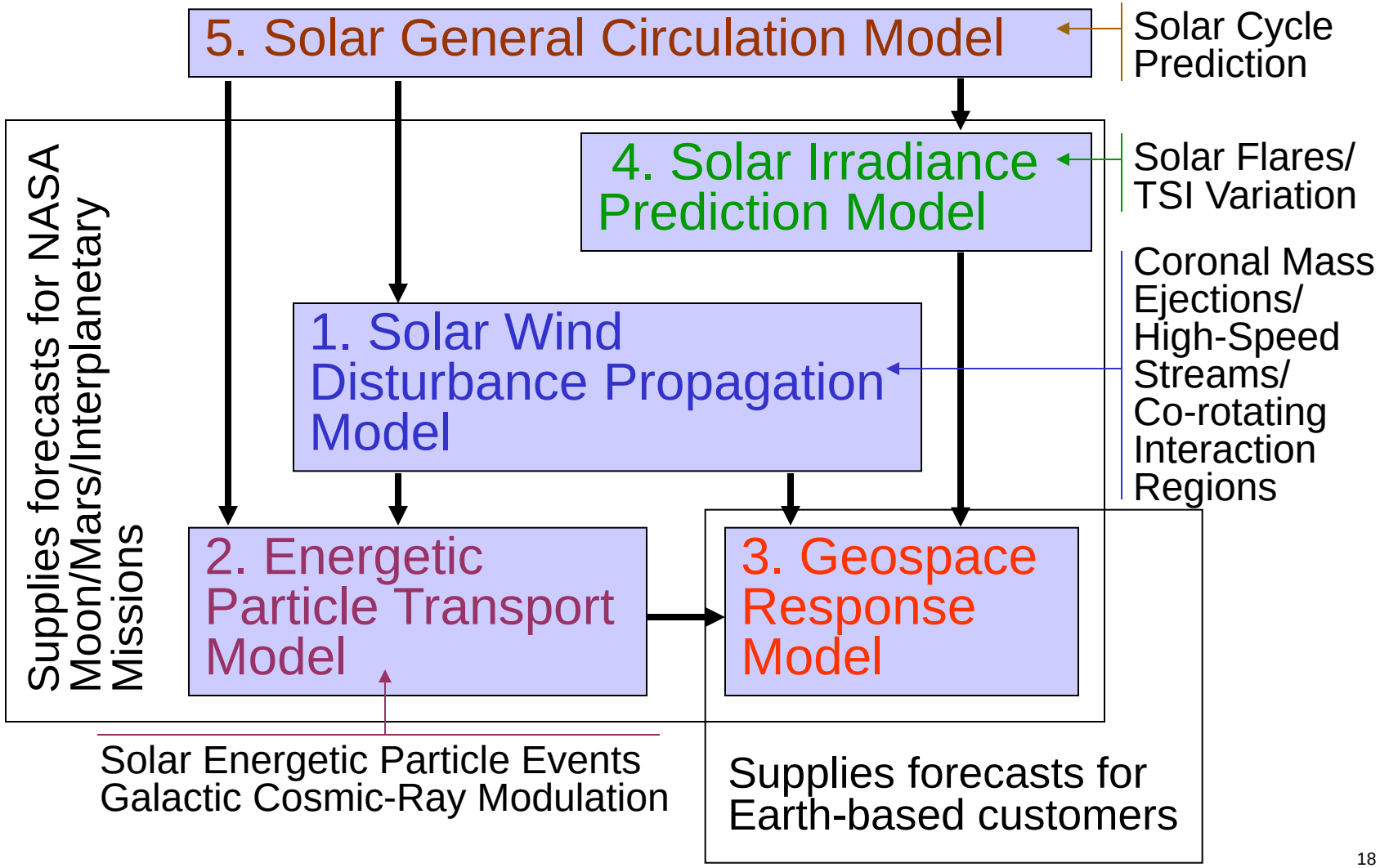
L1 Solar Wind Monitor

- DSCOVR Trilateral Partnership
  - USAF: Launch Vehicle?
  - NASA: DSCOVR spacecraft?
  - NOAA: Refurbishment, O+M Costs?
  - Fate of the TRIANA Climate Sensors?
- Commercial Data Buy

An R2O Roadmap



A Vision for NOAA's Space Weather Modeling

- Current space weather numerical prediction models are empirical and driven by observed statistical correlations, climatology, and space situational awareness.
- A Sun-to-Earth chain of cause-and-effect space weather phenomena permits a modular approach to forecast and prediction.
- In order of increasing difficulty these forecast modules are:
  - Solar Wind Disturbance Propagation
  - Energetic Particle Transport
  - Geospace Response
  - Solar Irradiance Prediction
  - Solar General Circulation
- In order of cause-to-effect these forecast modules are:
  - Solar General Circulation
  - Solar Irradiance Prediction
  - Solar Wind Disturbance Propagation
  - Energetic Particle Transport
  - Geospace Response
- The intrinsic potential for increased lead times for severe space weather warnings is as follows:
  - Solar Wind Disturbance Propagation [hours to days]
  - Energetic Particle Transport [minutes to hours]
  - Geospace Response [minutes to hours]
  - Solar Irradiance Prediction [hours to years]
  - Solar General Circulation [hours to years]
- All component modules of the end-to-end space weather numerical prediction suite will require:
  - Extensive ingest and assimilation of a wide variety of ground-based and satellite data to maintain fidelity.
  - Vast numbers of CPU and Cycle on high performance computing platforms, to achieve the requisite spatial and temporal resolution dictated by the underlying physics.
  - Periodic refresh of model methods and algorithms as new research becomes available and as customer needs continue to evolve for superior products and services.

SWPT: Space Weather Prediction Testbed

Space Weather Prediction Testbed
Study Report

28 February, 2009

1. Executive Summary

The NOAA Space Weather Prediction Center (SWPC) and the Air For
(AFWA) have requested a study of a Space Weather Prediction Testbed
drafted a Concept of Operations for such a Testbed, formulated a conceptual
licited input from the space physics research community, and evaluated imple
Our principal recommendations are as follows:

- There is a clear need for some type of national facility for testing and ev
cal models of the space weather environment, and transitioning them to opera
- These functions could be performed by an existing organization, suc
CCMC, or performed by a new organization implemented in a scientifically
department, industrial organization, or federally-funded research and develop
- The activity should be put out for competitive bids and competing proposals evaluated in a

active collaborative role in the endeavor.

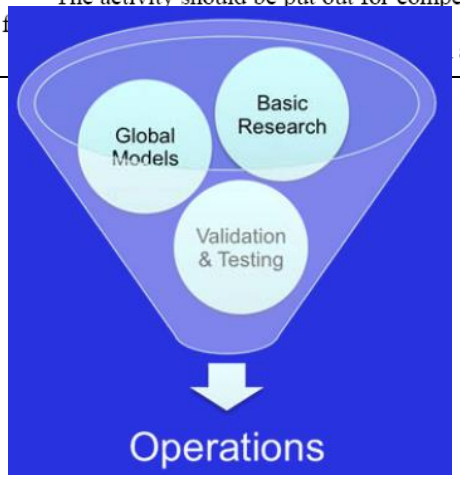
SPACE WEATHER: RESEARCH TO OPERATIONS (R2O)
A COMMUNITY PROPOSAL

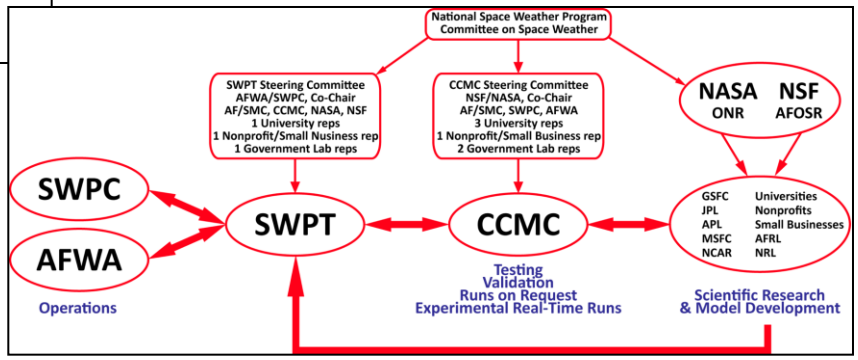
1 OBJECTIVE

The DoD and NOAA have the U.S. Government responsibility for providing operational space weather support for military and civilian customers (in practice these responsibilities are delegated to AFWA and SWPC). In addition, the growing commercial sector also has a stake in space weather. Both the government and the commercial sector have an urgent need for urgent need to establish a fair and efficient research-to-operations (R2O) pipeline and governance structure that encourages participation by everyone involved in the space weather enterprise.

The goal of this document is to outline possible models for the R2O process and governance.

2 PRESENT SITUATION





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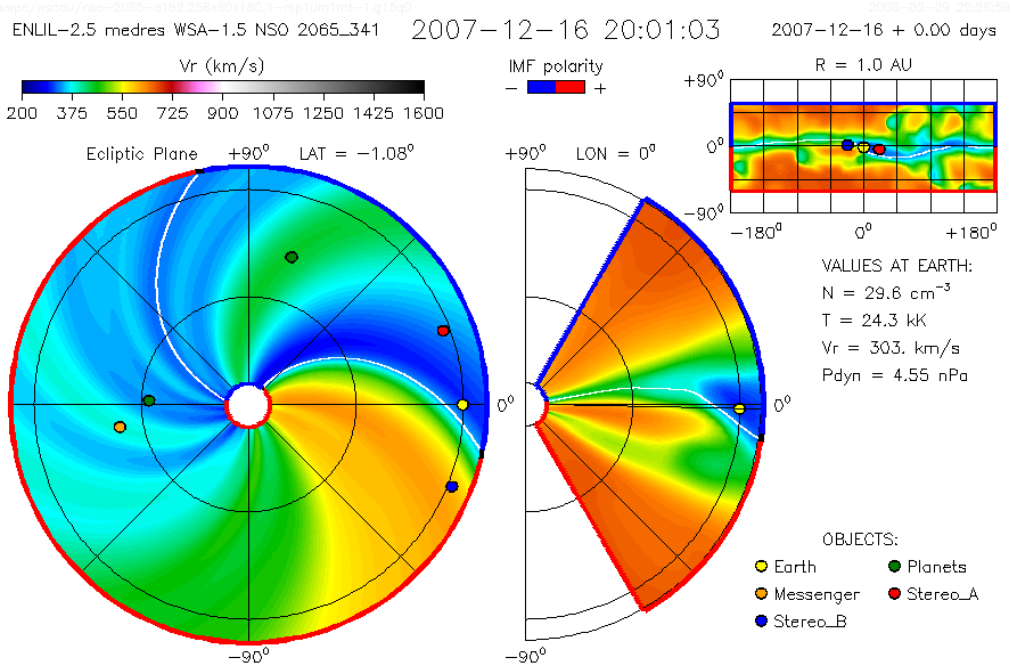
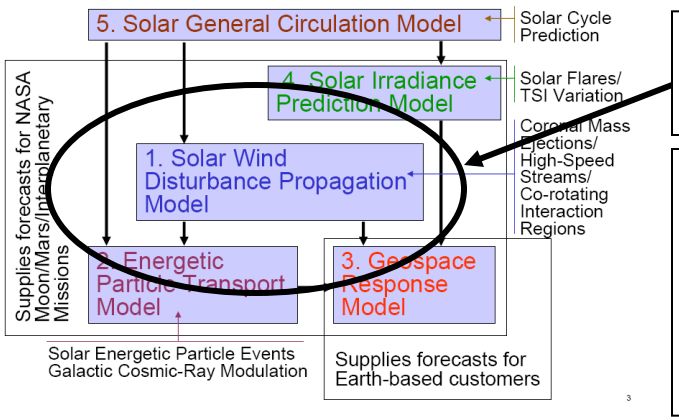
SWPT: The First Year





ENLIL

Providing 1-4 day advance warnings of geomagnetic storms: Putting the 'P' in NCEP and SWPC for advanced-technology based customers around the globe.

- Begins in FY2010
- Based at DSRC
- IP Agreement with CU
- CCMC Partnership
- AFRL Partnership
- NCEP Partnership
- SWPT: Vic Pizzo
- SWPTIG: Bob Schunk
- AFWA/SWPC

IT: Certification & Accreditation Plan of Action and Milestones

C&A Review	POAMs Closed to Date	POAMs to be Closed in FY09	POAMs to be Closed in FY10	POAMs to be Closed in FY11	Total POAMs Identified by Review	% of POAMs Closed to Date
2005	7				7	100%
2008	9	8	10	14	41	22%
Enabled by FY09 NCO/NWS $ Augmentation		4	8	4	16	

- NCEP/NWS invested $1.2M in FY2009
- Additional $1.2M is anticipated in FY2010
- Remainder in FY2011
- Interim Authority to Operate in effect
- Close out of Legacy Systems

	Data Acquisition, Level 0/1 Data Processing	Product Service, Level 2/3 Data Processing
Primary Facility	NESDIS SOCC	SWPC DSRC
Backup Facility	NESDIS Wallops	AFWA Offutt AFB

Safeguarding Our Nation's Advanced Technologies

IT: External-Space Weather Data Server (E-SWDS)

A real-time relational database of operational data available to external users

Not a replacement for current ftp and web interfaces

Available to:

- Emergency management community
- Federal, state, local and tribal level officials and contractors
- Government partners
- Agencies whose partnership requires close coordination with SWPC
- Commercial Service Providers who operate systems that routinely and rapidly relay SWx products, watches, advisories, warnings, and forecast information to consumers
- International space weather partners and ISES Regional Warning Centers or government entities that provide the exchange of SWx information and forecasts.

Users must be approved by SWPC

Users are expected to be familiar with relational data base technology, include SQL, and necessary communications protocols.

New Partnerships for Progress

- UCAR-sponsored Independent Review of SWPC [June 8-10, 2009: Genene Fisher]
- ESA/DLR/RRA discussions on ACE R/T data acquisition and delivery services
- SWPC/ISES/WMO Space Weather Initiative
- SWPC/AFWA Coordination Committee
- SWPC/NGDC Data Stewardship Initiative
- SWPC/USGS Boulder Magnetometer Transfer
- SWPC/FAA NextGeneration SWx Requirements Study
- SWPC/AFSPC Space Situational Awareness Participation
- SWPC/CSWIG Summit [April 30, 2009]

Ultimate Driver

Solar Maximum ~~2012~~ 2013 2014

Ready or Not – Here It Comes

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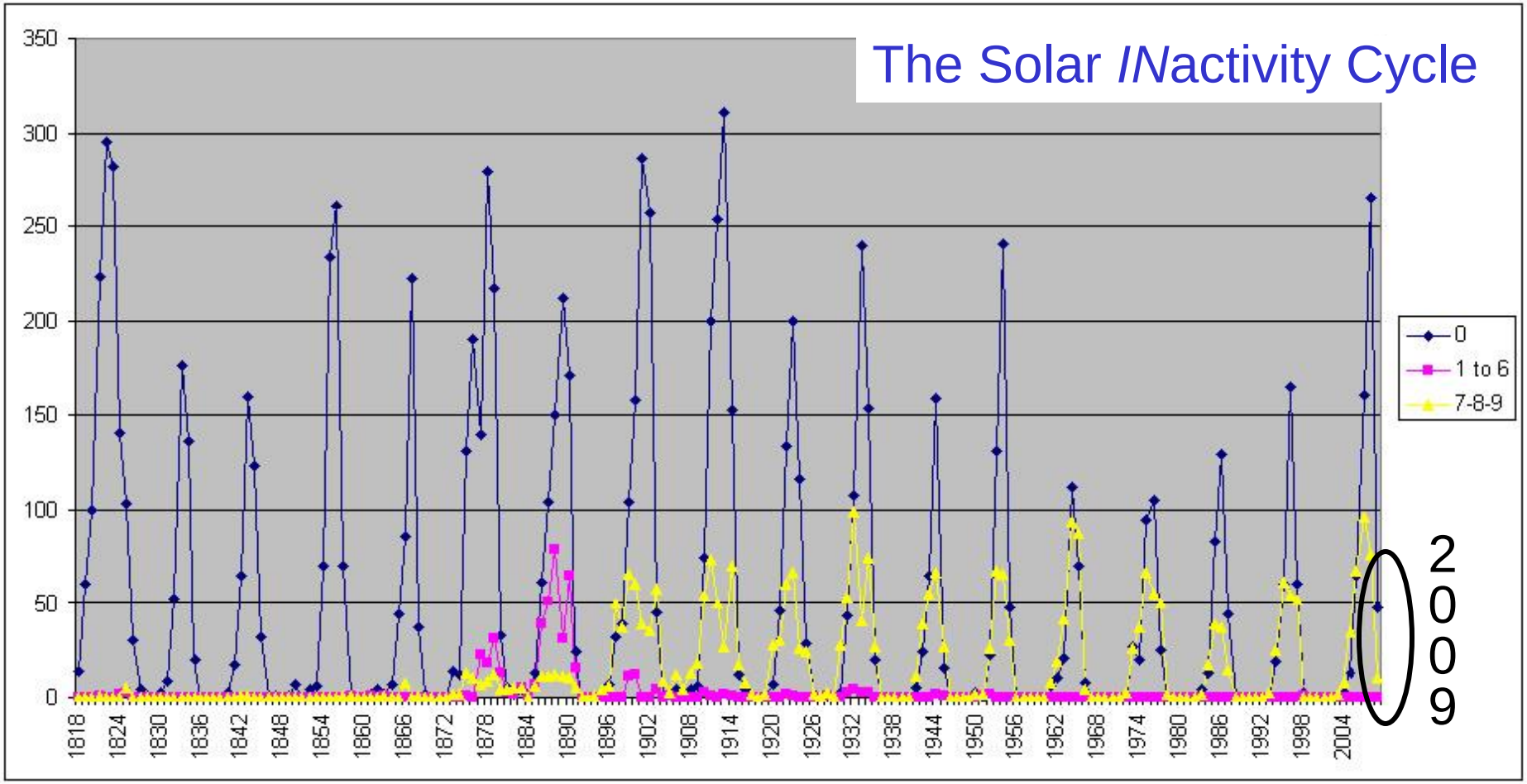
Backup Slide: The Sun as a Cue Ball 1818-2009



Number of days per year for which the daily sunspot number was, **0**, **1 to 6**, and **7 to 9**. [Courtesy Bill Denig, NOAA/NGDC]