Vision on Implementation of Space Weather R2O2R – NOAA Perspective

NOAA
National Weather Service

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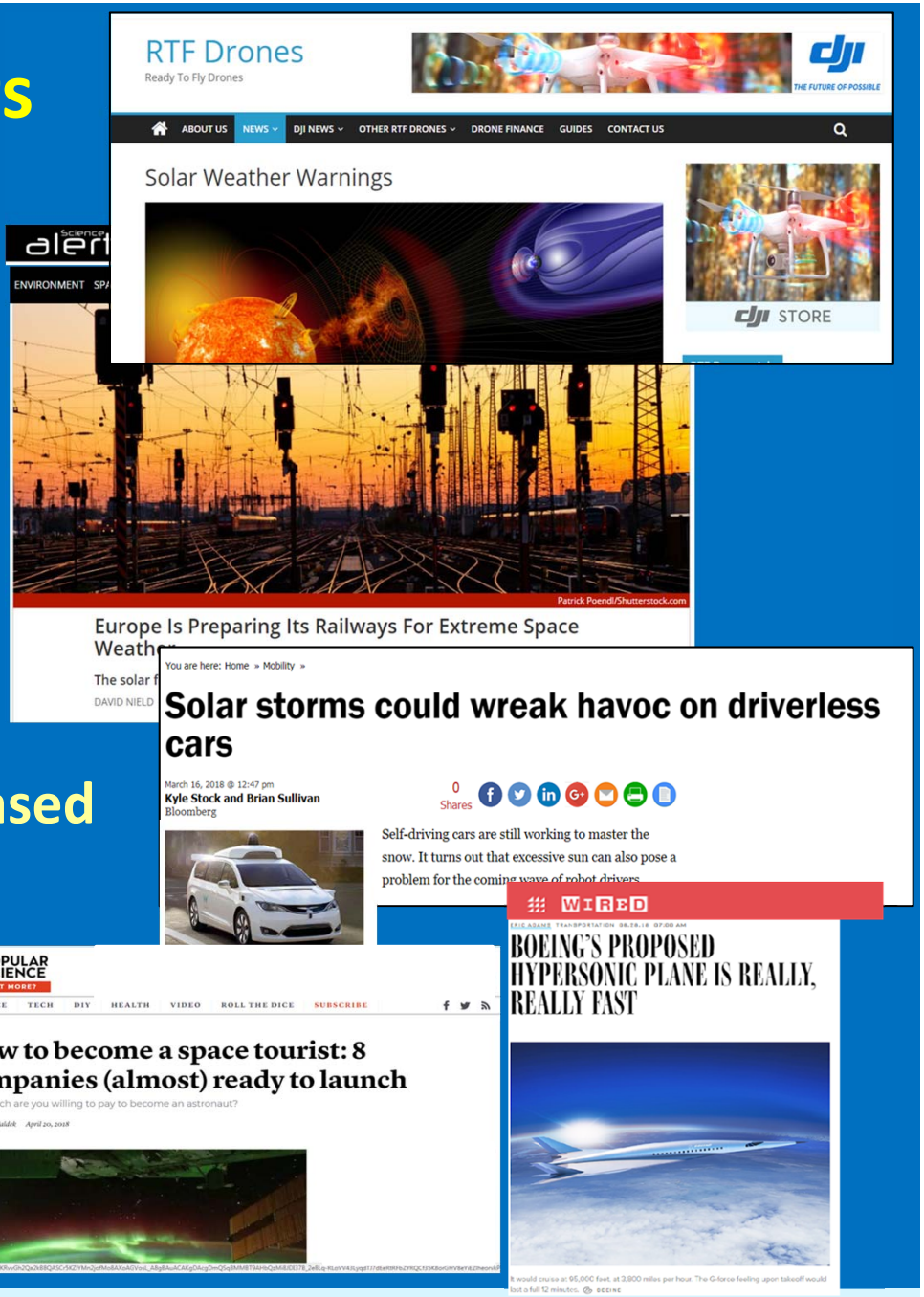
Adapting To Consumers Evolving Needs

Community must anticipate products to support needs of a rapidly evolving technological society

- **Autonomous vehicles**
- **Advanced Rail Technologies - Positive Train Control (GPS-based safety system)**
- **Supersonic and Hypersonic transport**
- **Space Tourism**
- **Drone technology**
- **Deep space exploration**



National and International Policy Driving SWPC Services

Space Policy Directive-1: Reinvigorating America's Human Space Exploration Program (Dec 2017)
Space weather observations and prediction critical for space travel

UN International Civil Aviation Organization (2019)
Implementing a space weather information service for global information

Space Weather Strategy Update (2019)
Identify mechanisms for sustaining and transitioning models and observational capabilities from research to operations

Ensuring Continuity of Critical Observations to Support Operations and to Inform and Validate Research

GONG – NOAA now supporting the Operations and Maintenance of the Observatories

- SWPC working with NSF/NSO and NOAA/IDP program to operationalize processing of GONG data

GOES – Currently Operational with GOES 14&15

- GOES-16 operational early FY20
- GOES-17 operational mid FY20


GOES

Space Weather Follow-On + Operational Coronagraph

- Host coronagraph on GOES-U, launch in 2024
- Rideshare to L1 with NASA's Interstellar Mapping and Acceleration Probe (IMAP) late 2024

(Updates from NESDIS tomorrow)

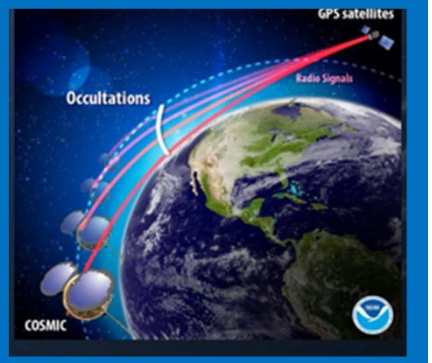
Critical Observations to Support Operations and to Inform and Validate Research

COSMIC-2A - six satellites into low-inclination orbits – launch in 2019

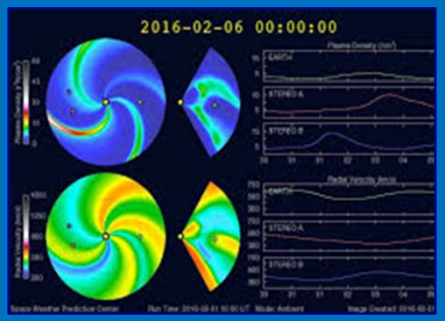
NOAA Commercial Weather Data Pilot - NOAA exploring demonstration projects to validate the viability of commercial environmental data for NOAA's models

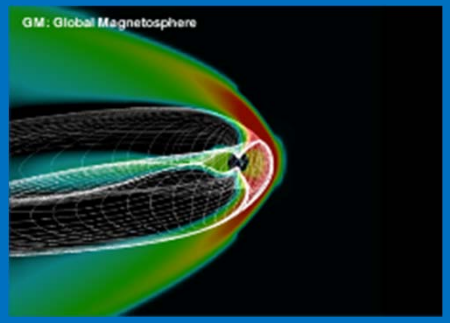
- NOAA selected GNSS radio occultation (RO)
- NOAA will evaluate commercial data to demonstrate quality and impact to models

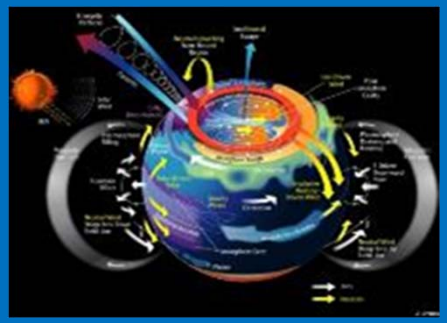
(Updates from Spire Global, GeoOptics, and PlanetIQ tomorrow)

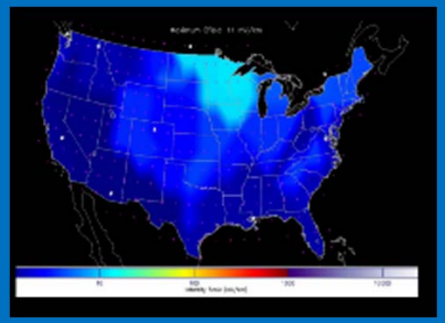


Operational Space Weather Modeling at NOAA – A Sun to Earth Continuum









GMU/AFRL WSA/Enlil	U. Michigan Geospace	NOAA/CIRES WAM-IPE	NOAA/USGS E-field
Understand the structure of the solar wind as it propagates from the Sun to Earth	Understand the geomagnetic response to changes in solar wind; provide regional predictions of geomagnetic storms	Understand details in the mesosphere, exosphere, and ionosphere, to understand links between the lower and upper atmosphere	Characterize and predict the regional electric field and the associated currents that impact electric power grid
Operational since 2011	Operational Sept 2016	Operational FY20	Operational FY19

Coordinated Interagency Space Weather Applied Research Funding

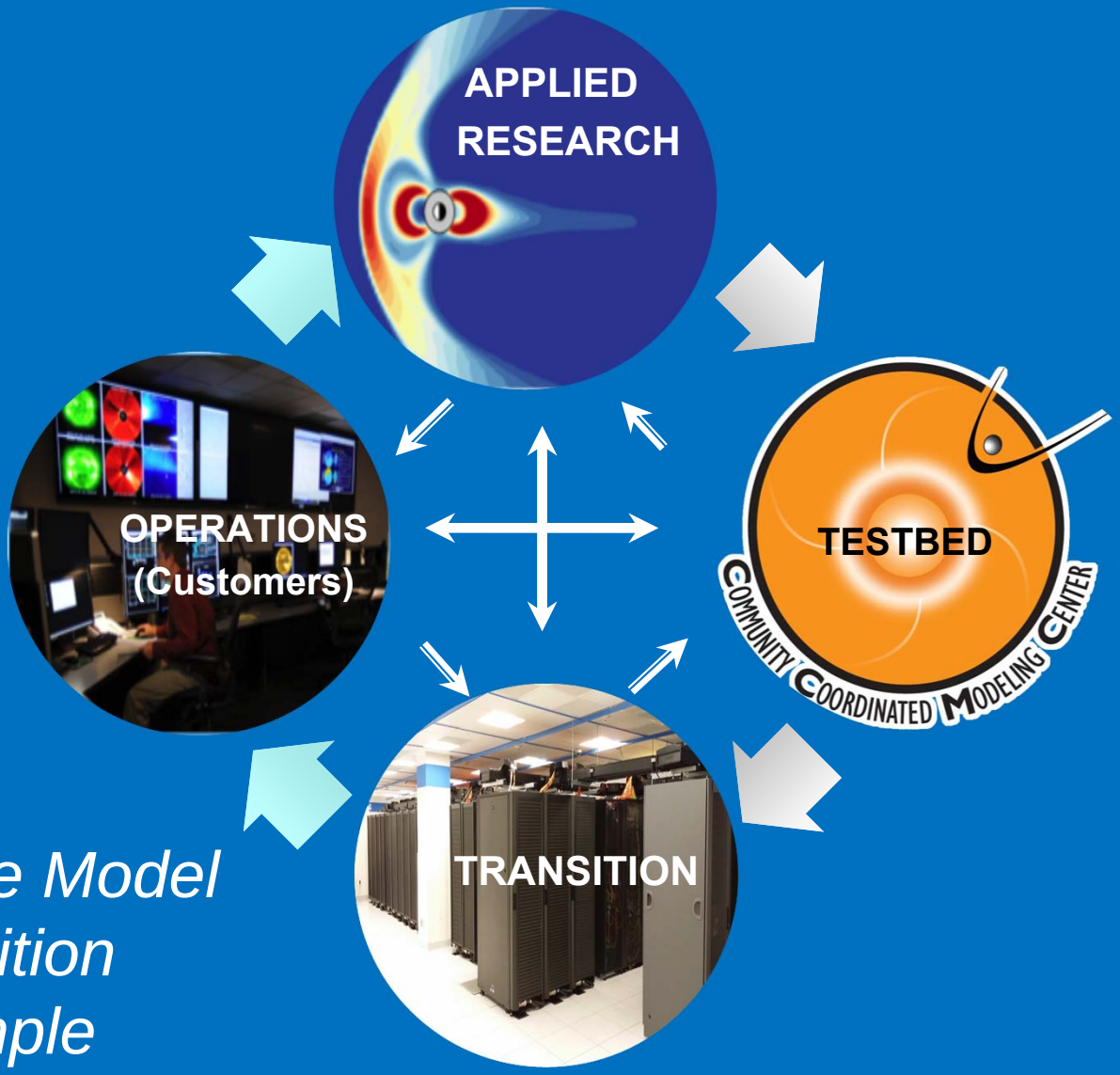
Tri-Agency NASA, NOAA, NSF Memorandum of Understanding

- Enables ongoing multi-agency coordination of research topics

NASA Budget - "...enhancing the ability to forecast and characterize space weather events in collaboration with NASA's interagency partners."

Applied research projects look to provide a "Conveyer Belt" of solutions and capabilities for operational forecasting.

RESEARCH TO OPERATIONS TO RESEARCH CYCLE



Geospace Model Transition example

What is needed…

An improved R2O2R process for space weather that serves both operational forecasting and research needs

Existing process: Piecemeal, competing research efforts with little consideration or understanding for effort and expense involved in transitioning research models into an operational system. Multiple challenges:

- Intellectual property rights
- Distribution of codes
- Modification to models
- Verification and validation
- Documentation
- Lack of oversight
- Incorporating forecaster and user feedback

A Strategy:

Enhance existing capabilities

- Establish performance metrics and benchmarks
- Prioritize space weather research on operational needs and requirements
- Implement a prototype O2R project

Expand Federal capabilities to establish the fundamental elements of R2O-O2R activities

- Establish community models
- Support research and development on operational models
- Identify computational resources requirements

Conclusion

Forecasting Space Weather will advance through:

- New and sustained observations
- Advances in space science understanding and research in partnership with private sector and academia
- Improved/accurate numerical prediction models
- The transition to operations: improved models and post-processing through effective R2O2R

These actions, aligned with the needs of a growing customer base, will enable NOAA to serve the Nation with consistent, accurate, and actionable information