# Building New Understanding of our Earth: From the Sun to the Sea

## NOAA'S National Weather Service Space Weather Progress and Challenges

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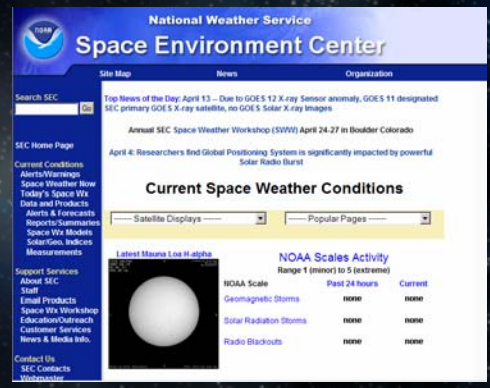
NOAA Assistant Administrator For Weather Services and
National Weather Service Director

Space Weather Workshop
April 25, 2007

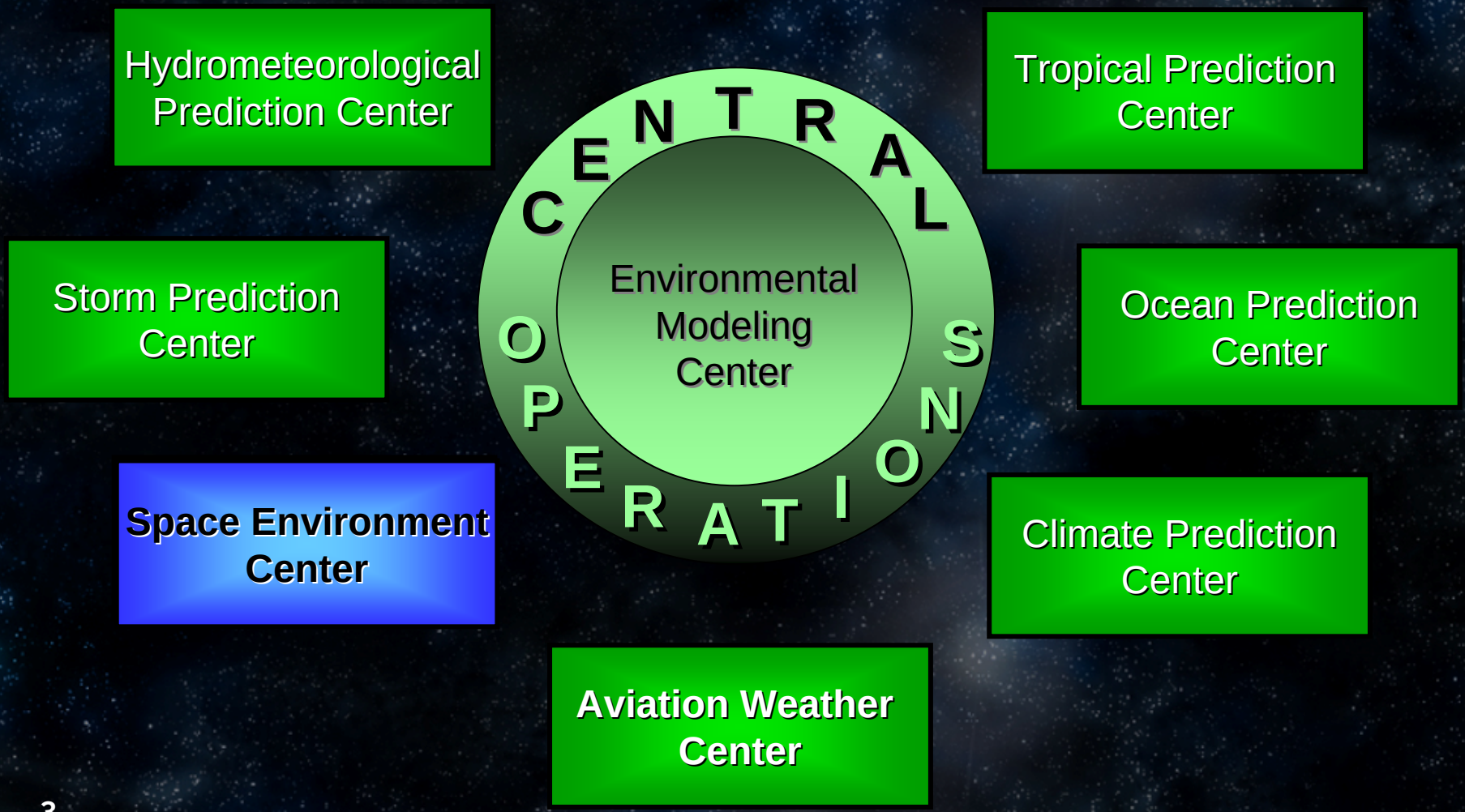
# Presentation Overview

- "Operational" Space Weather
  - Integration of Space Weather Into NWS Services
- Growing Space Weather Needs:
  - Increased Polar Aviation Routes
  - New Commercial Space Industry
  - Global Positioning System Uses
  - Integration of Space Weather Into NGATS
- Satellite Continuity and Growth
  - Space Weather Instrumentation
  - GOES-R and NPOESS



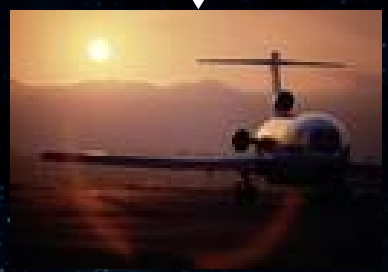

# *Integration of Space Weather Into NWS Services*

## NWS National Centers



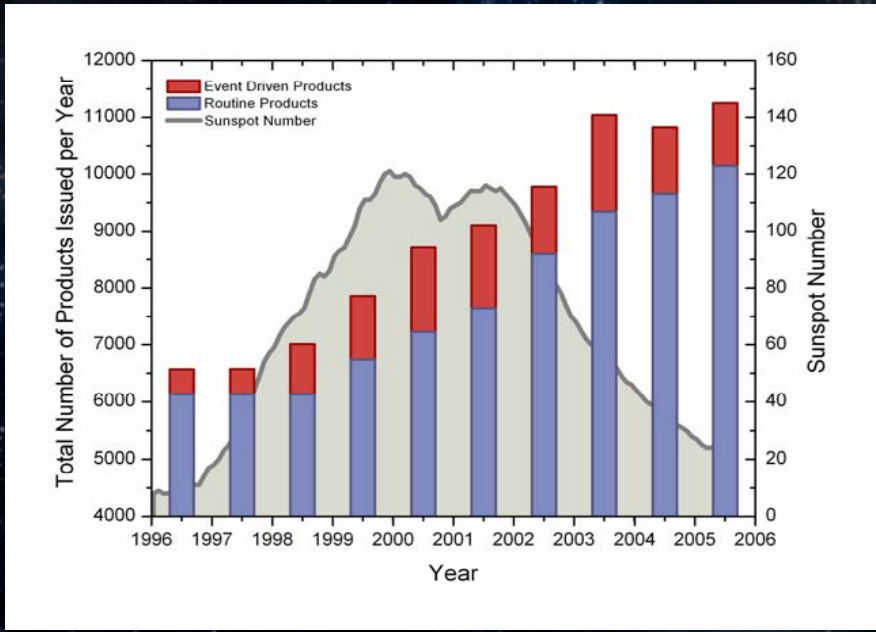
# NWS Space Weather Mission

**The objectives of the National Weather Service Space Weather Service Program are to provide space weather forecast information and services to the Nation for protection of life and property, and to develop new products and services to meet the needs of users of space weather information and services.**




# Integration of Space Weather Into NWS Services

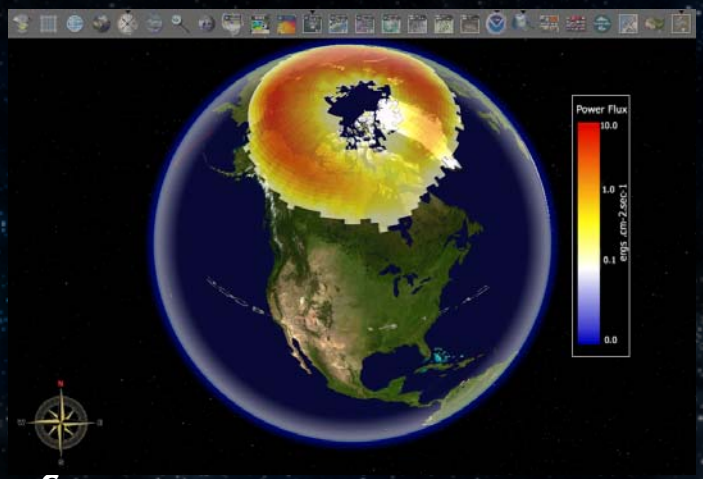
## NWS to Continue Development of Space Weather Products

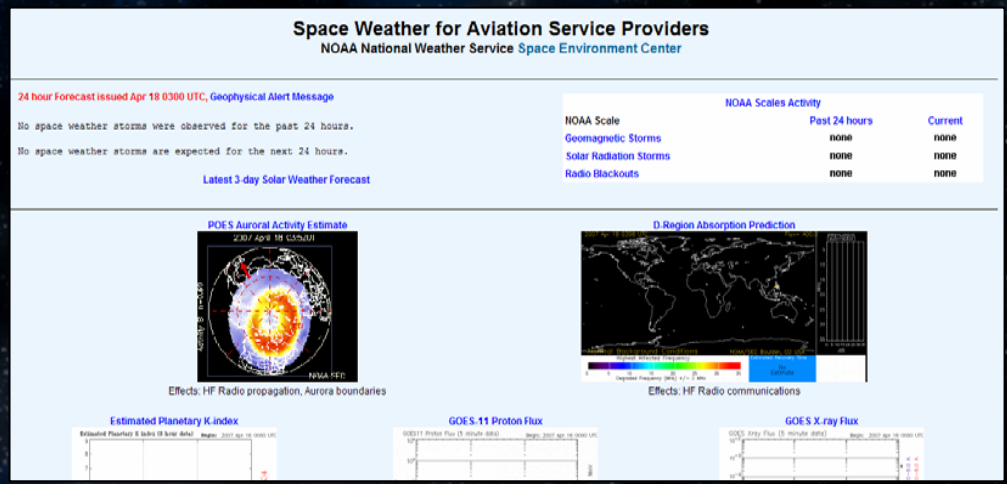



- The demand for space weather products is increasing regardless of stage of solar cycle.
- Strong solar storms impacting critical technology infrastructure occur every year of the solar cycle.

# Integration of Space Weather Into NWS Services

- NWS Aviation Center is working with the Space Environment Center (SEC) to provide aviators with space weather information
- SEC is working with WFOs on a new aurora forecast product
- Space weather is now an important part of the NWS suite of products



# Aurora Forecast Product from the Glasgow Weather Forecast Office in coordination with the NOAA Space Environment Center

NOUS45 KGGW 131806

PUBLIC INFORMATION STATEMENT
NATIONAL WEATHER SERVICE GLASGOW MT
1100 AM MST WED DEC 13 2006

...NORTHERN LIGHTS POSSIBLE AGAIN THURSDAY EVENING...

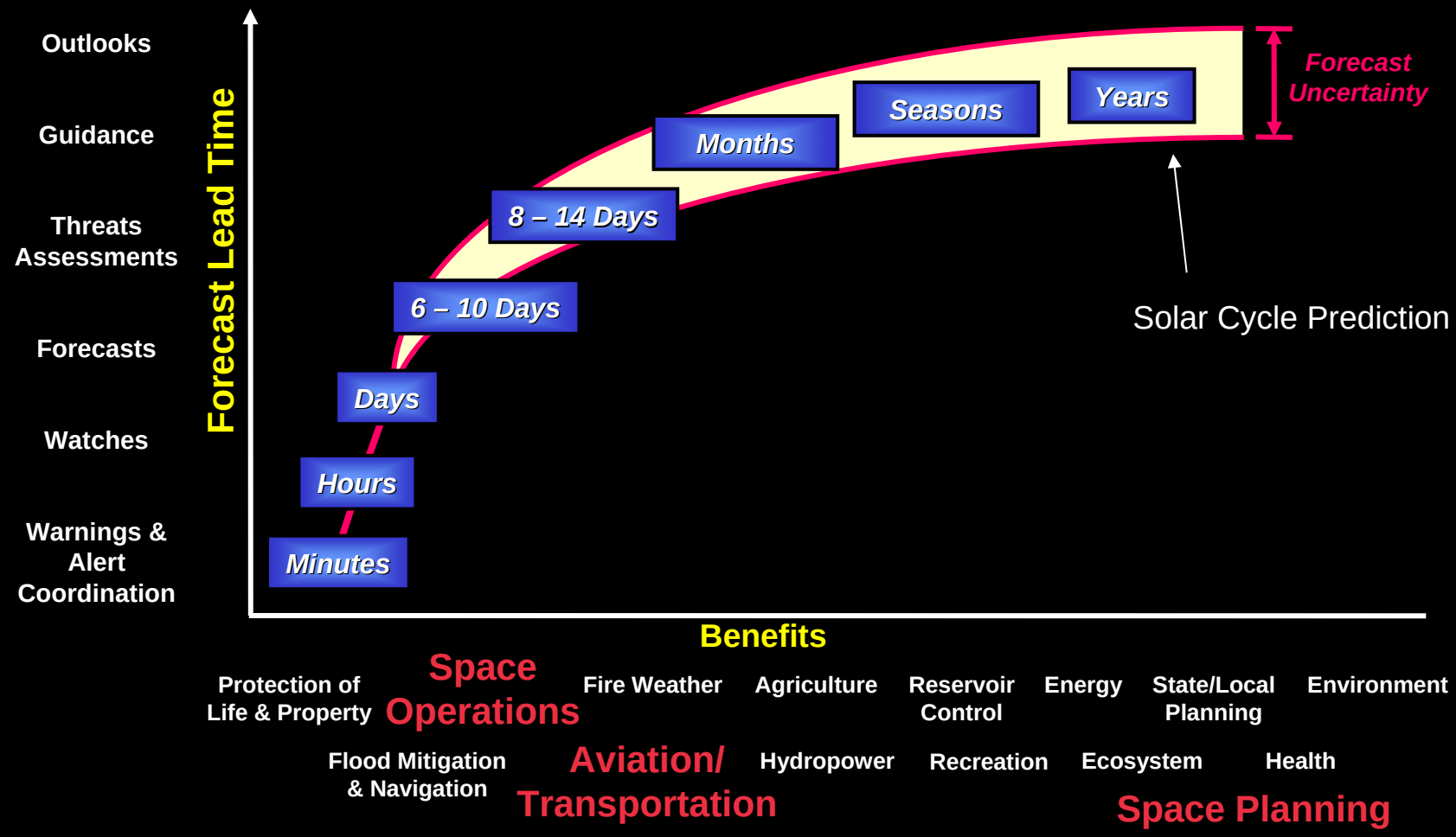
ON TUESDAY EVENING...THE SUN HAD ANOTHER SOLAR FLARE THAT IS **EXPECTED TO ALLOW FOR VIEWABLE AURORA ACTIVITY ON THURSDAY NIGHT [14 Dec]** IN NORTHEAST MONTANA...THE BEST VIEWING WILL BE FROM SUNDOWN THROUGH ABOUT 9 PM. A WEATHER SYSTEM IS EXPECTED TO MOVE INTO THE AREA LATE THURSDAY NIGHT BRINGING IN CLOUDS THAT WILL OBSCURE THE SKY BY LATER IN THE EVENING.

North Dakota – 14 Dec 2006


Iowa – 14 Dec 2006

# NWS Overview

## Seamless Suite of Products



# Growing Space Weather Needs

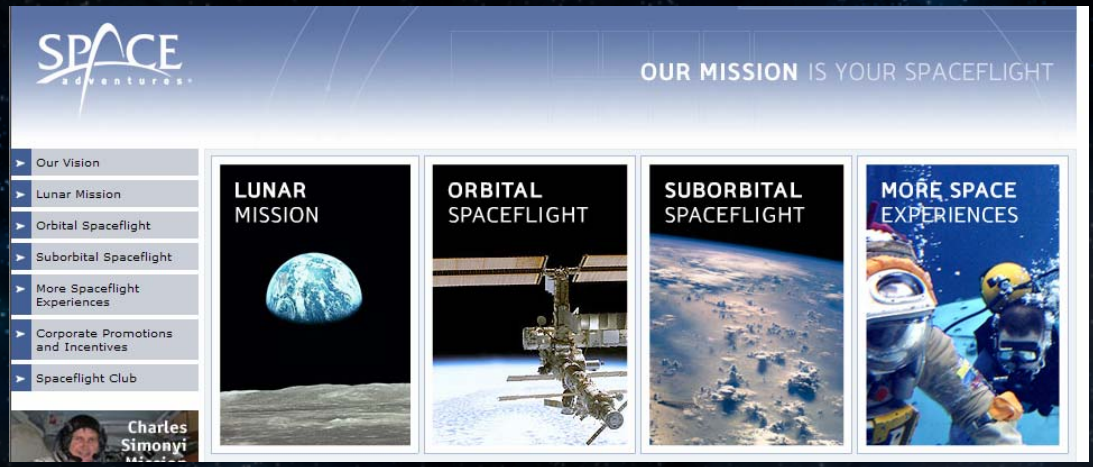
- An ever-growing dependence on advanced technology is resulting in an increased need for space weather services
- Customer needs are evolving and increasing significantly
- New customers with new concerns emerging
- Are we ready???

# Growing Space Weather Needs

## The Dawn of a New Era – Commercial Human Space Flight

Four commercial space transportation companies officially involved in commercialization of low-Earth orbit, developing capabilities to transport goods and people to orbital destinations.

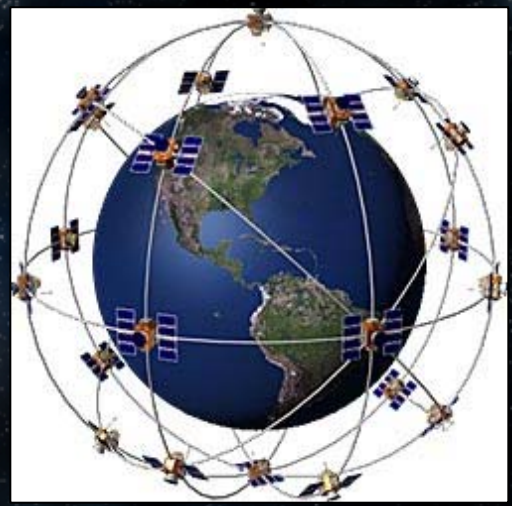
- Suborbital space tourism
- Point-to-point commercial space flight services (rapid global transportation)
- Commercial spaceports, and space hotels
- NASA crew and cargo services to the international space station
- Commercial Lunar flyby




# Growing Space Weather Needs

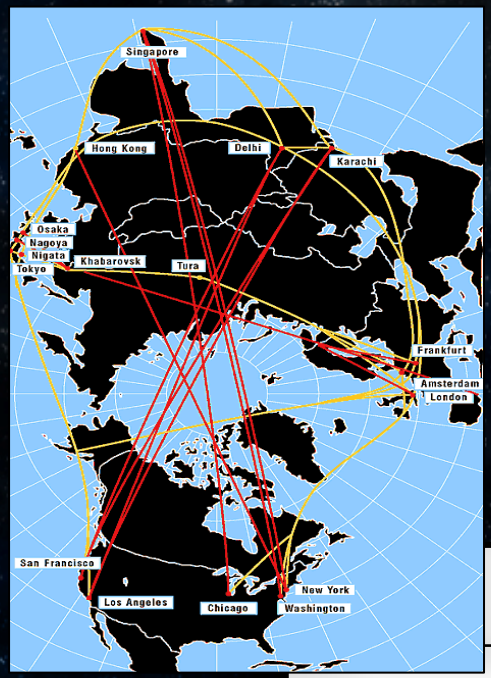
- GPS (Global Positioning System) users represent the fastest growing customer base for SEC space weather products
- Use of GPS is exploding – vehicle navigation systems, railway control, highway traffic management, emergency response, aviation, marine and land surveying, and much more…
- New concerns have emerged about the impact of solar radio bursts on GPS.
- GPS Global Production Value – expected growth:

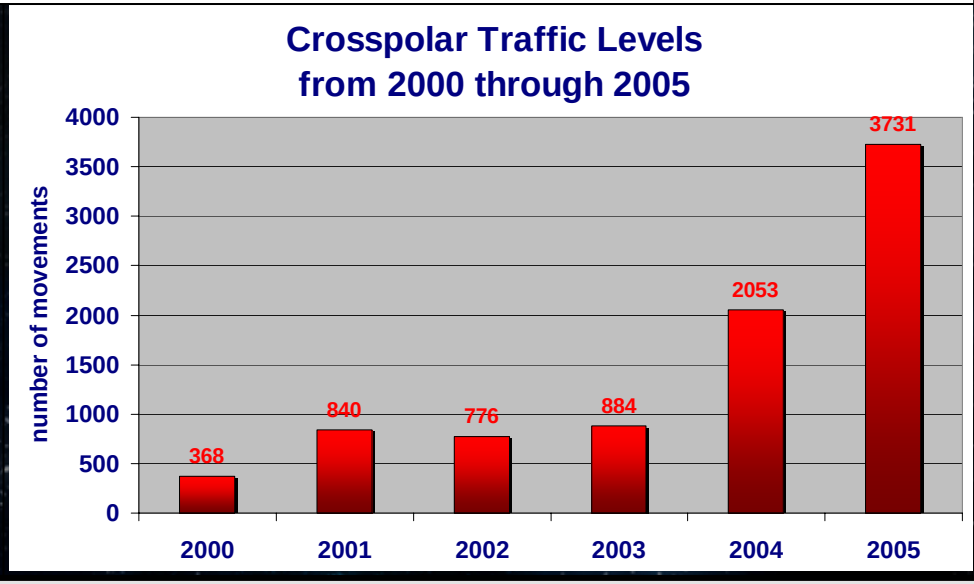
2003 - $13 billion
2008 - $21.5 billion
2017 - $757 billion



# Growing Space Weather Needs

## Aviation Growth




*Predicted Polar Route Passenger Movement*

| | 2004 | 2009 | 2014 | 2019 |
|---|---|---|---|---|
| Capacity | 228,000 | 384,000 | 972,000 | 1,768,000 |
| AAGR | | 13.9% | 20.4% | 12.7% |

# Growing Space Weather Needs

## *Integration of Space Weather Into NGATS*

### Space Weather Integrated in NGATS

- More Efficiency
- More Capacity
- More Profitable

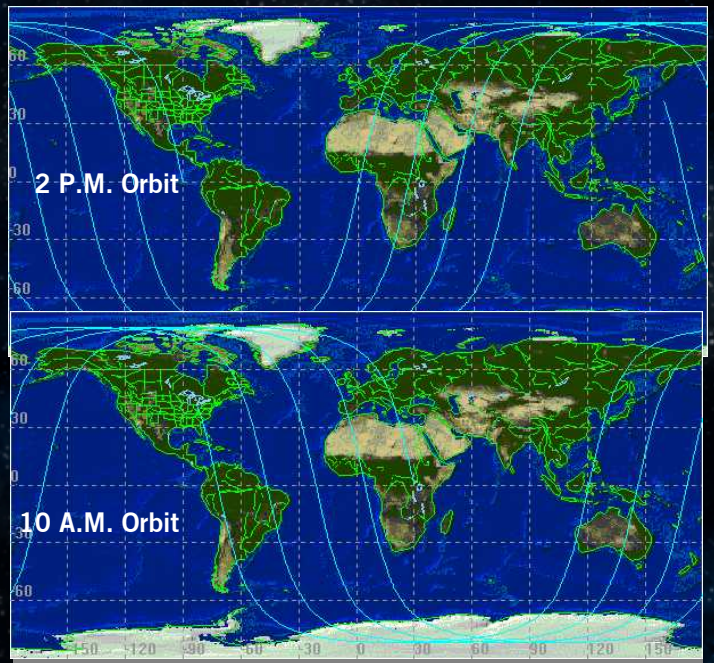
# Finding Solutions
## *Research to Operations*

"Research underpins NOAA's science-based mission…understanding and predicting changes in the Earth's environment involves a continually evolving process of discovery, observation, and analysis…"

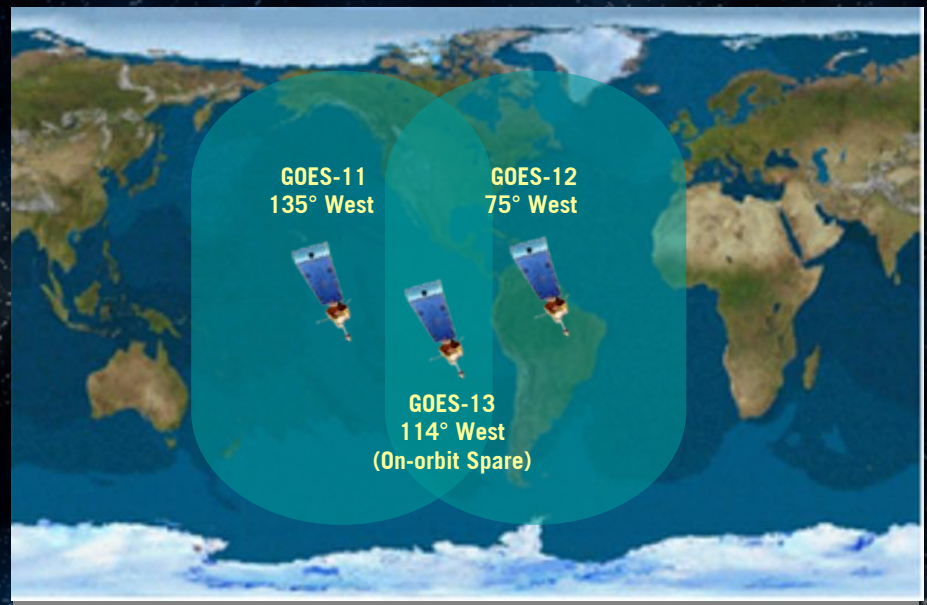
*—NOAA's 5 Year Research Plan*

- Balancing near-term and long-term research
- Informing policy debates
- Developing Earth System Model
- Integrated Observing System

# Satellite Continuity and Growth




- Two operational polar satellites; one in morning and one in afternoon orbit, yielding 6-hour global sampling
- Continuity of operations since early 1960s
- NOAA/EUMETSAT partnership for mid morning orbit with recent launch of Metop A

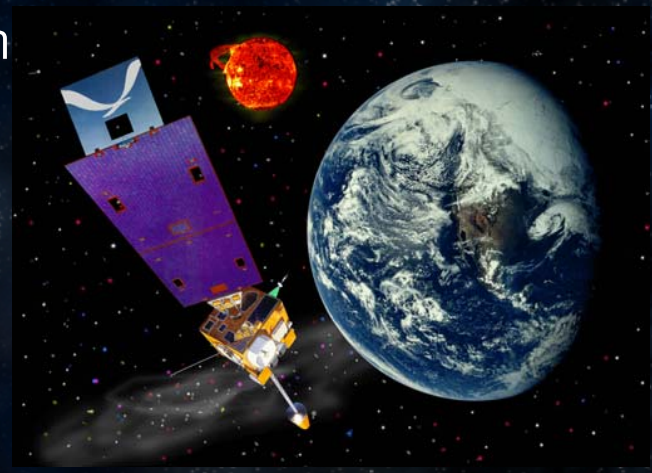



- Two operational geostationary satellites
- On-orbit spare
- Continuity of operations since 1974 (borrowed satellite from Europe, 1991-1994, to maintain two satellite continuity)
- Retired GOES-10 being moved to 60° West to improve South American environmental satellite coverage.

# Satellite Continuity and Growth

## Space Weather Instrumentation
## GOES 8-12

- Space Environment Monitor (SEM)
- Energetic Particle Sensor (EPS)
- Magnetometer (MAG)
- X-Ray Sensor (XRS)
- Solar X-ray Imager (SXI) – first on GOES 12



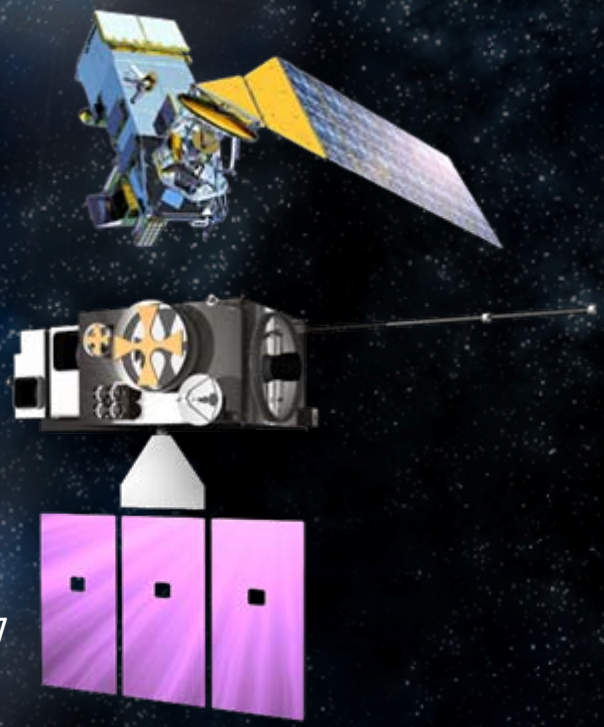
**Satellites:**

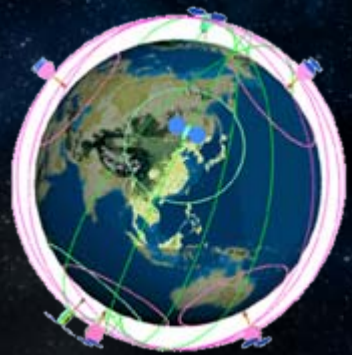
| | |
|---|---|
| GOES 8 | (Launch: 4/13/94, EOL orbit raising 5/5/04) |
| GOES 9 | (Launch: 5/23/95, loaned to Japan) |
| GOES 10 | (Launch: 4/25/97, South America Support) |
| GOES 11 | (Launch: 5/13/00, GOES-W) |
| GOES 12 | (Launch: 7/23/01, GOES-E) |
| GOES 13 | (Launch: 5/24/06, On-orbit spare) |
| GOES OP | (Boeing production) |
| GOES R | (2012 - ) |

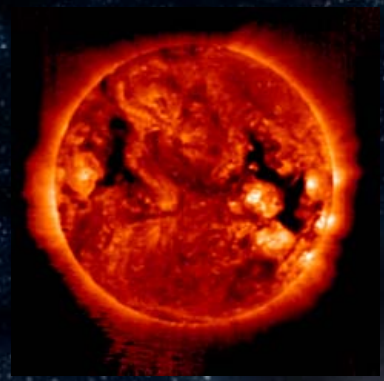
# Satellite Continuity and Growth

GOES-R and NPOESS will provide continuity to existing satellite constellation

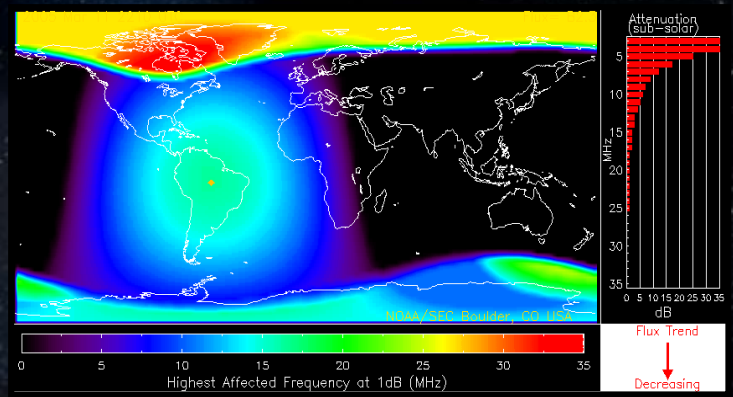
- GOES-R
  - Program Definition and Risk Reduction activities on-going– RFP release summer 2007
  - Instruments progressing
  - Lessons learned being incorporated
- NPOESS (Tri-Agency Program)
  - Certification through the Nunn-McCurdy process completed
  - Interim program on track
  - Restructure ongoing – contract mod by end of 2007

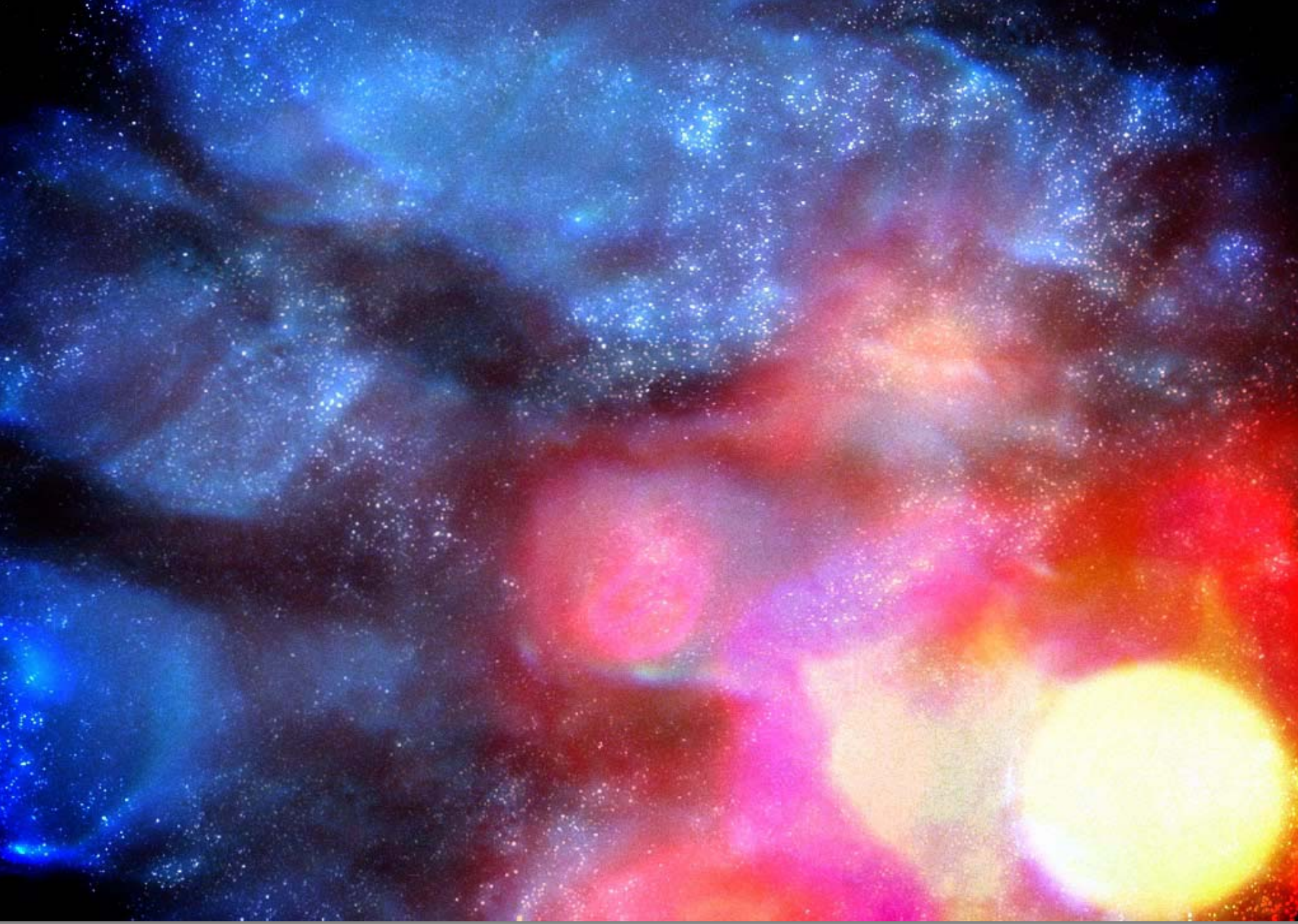






**Provide the right information, in the right format, at the right time, to the right people, to make the right decisions.**





***Email us at: NWS.Communications.Office@noaa.gov***

- BACKUP

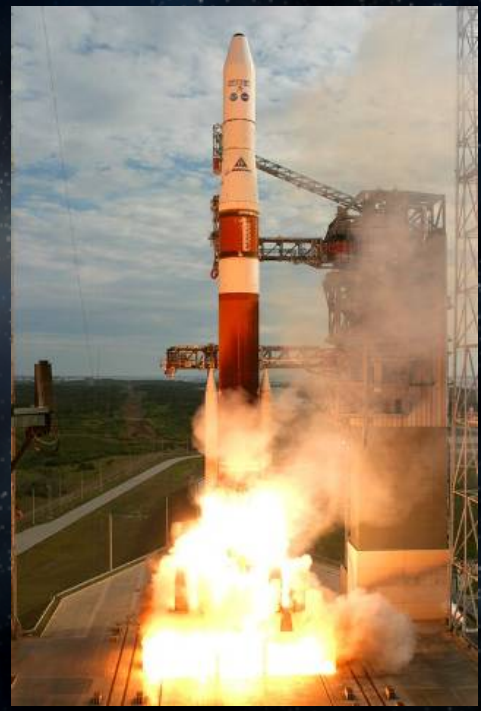
# Satellite Continuity and Growth

3 GOES-R Contracts Awarded

- Series will continue geostationary satellite program.

NPOESS a Priority

- Improvements will translate into weather models that lead to better forecasts and warnings and enhanced data and products needed for climate and ocean research and monitoring of space weather.



*GOES-N (13)*
*May 24, 2006*