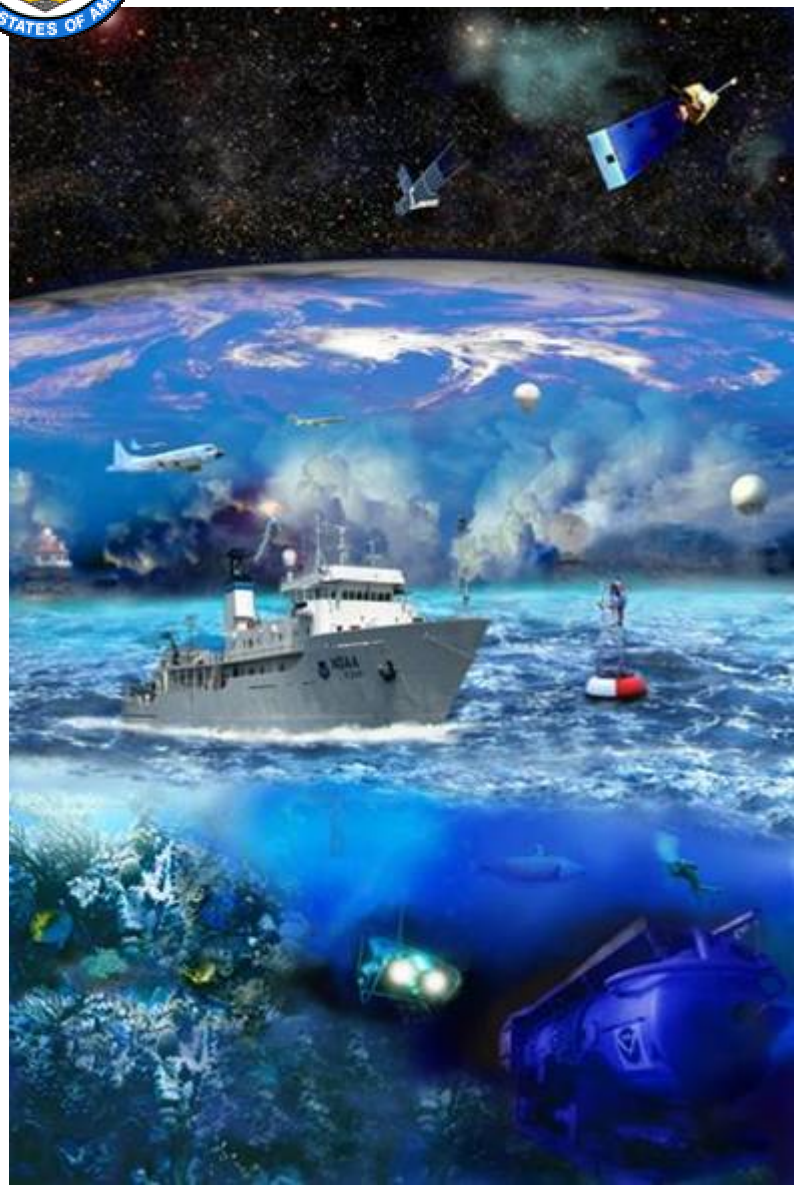


NOAA The Next 25 Years

Theme: Integrated Observing Systems

Alfred M. Powell, Jr

Acting Director

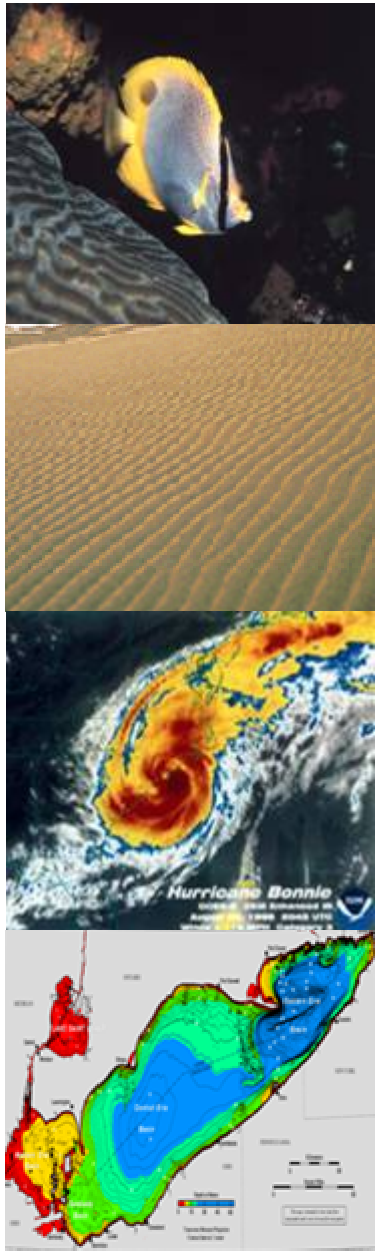
Office of Research and Applications*

*Center for Satellite Applications and Research

National Oceanic and Atmospheric Administration

July 11, 2005

NOAA’s Mission

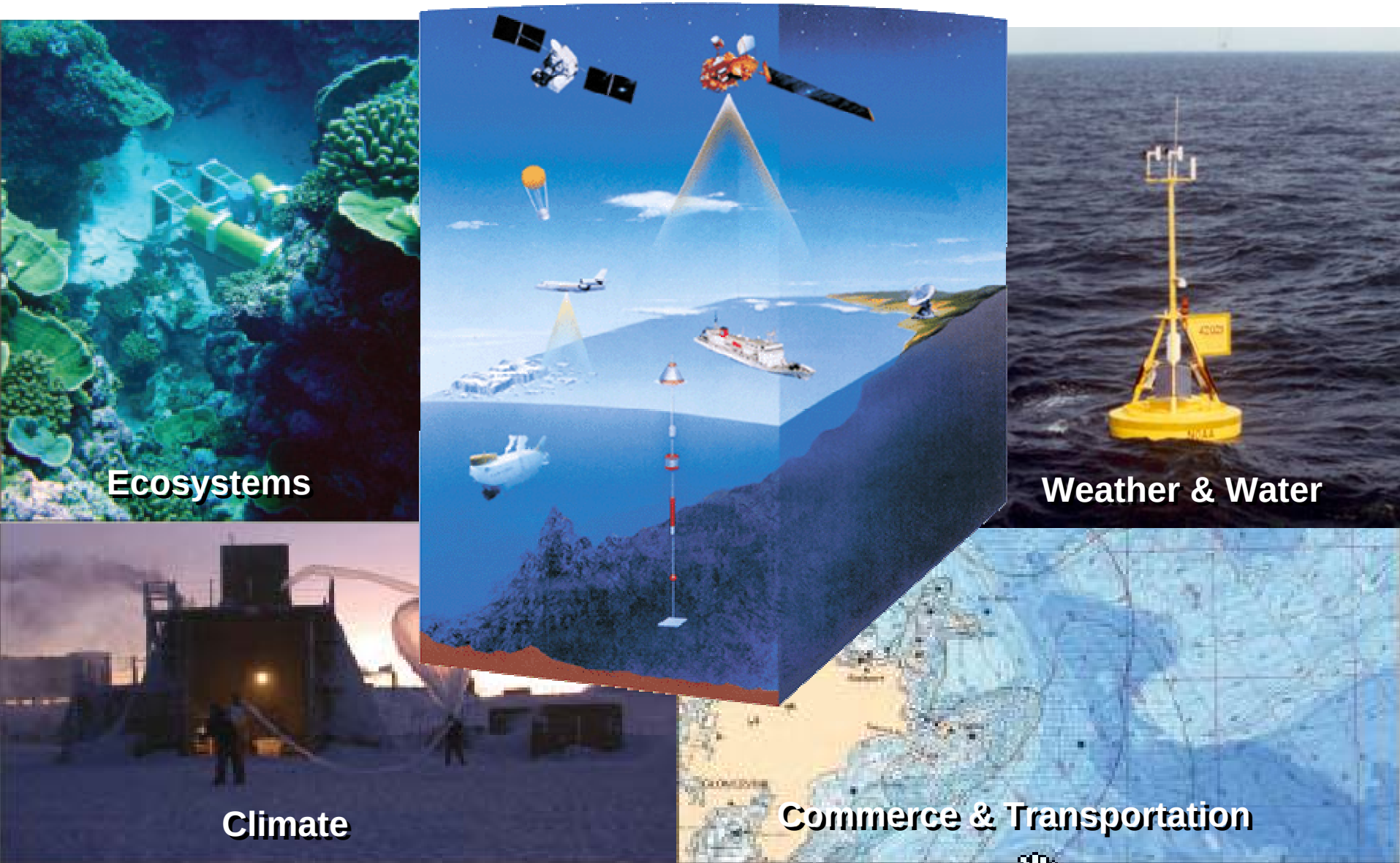


- **To describe and predict changes in the Earth’s environment.**

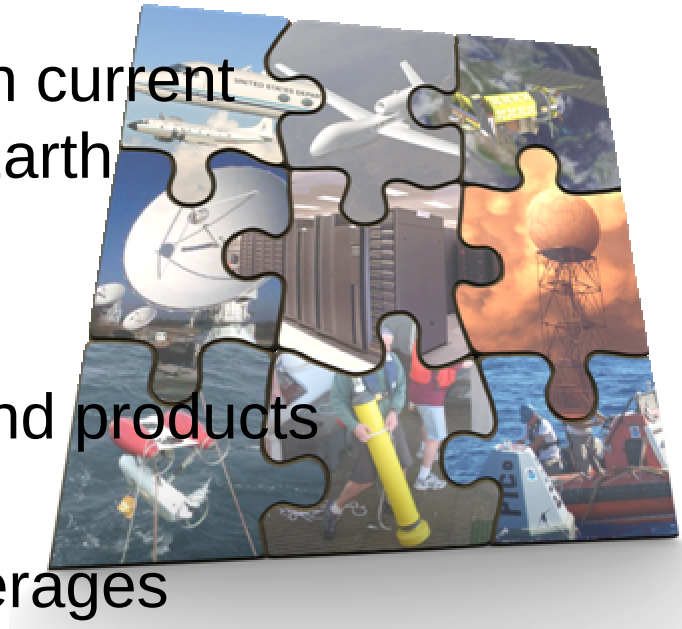
- **To conserve and manage United States coastal and marine resources to ensure sustainable economic opportunities.**

NOAA observations and data are essential for…

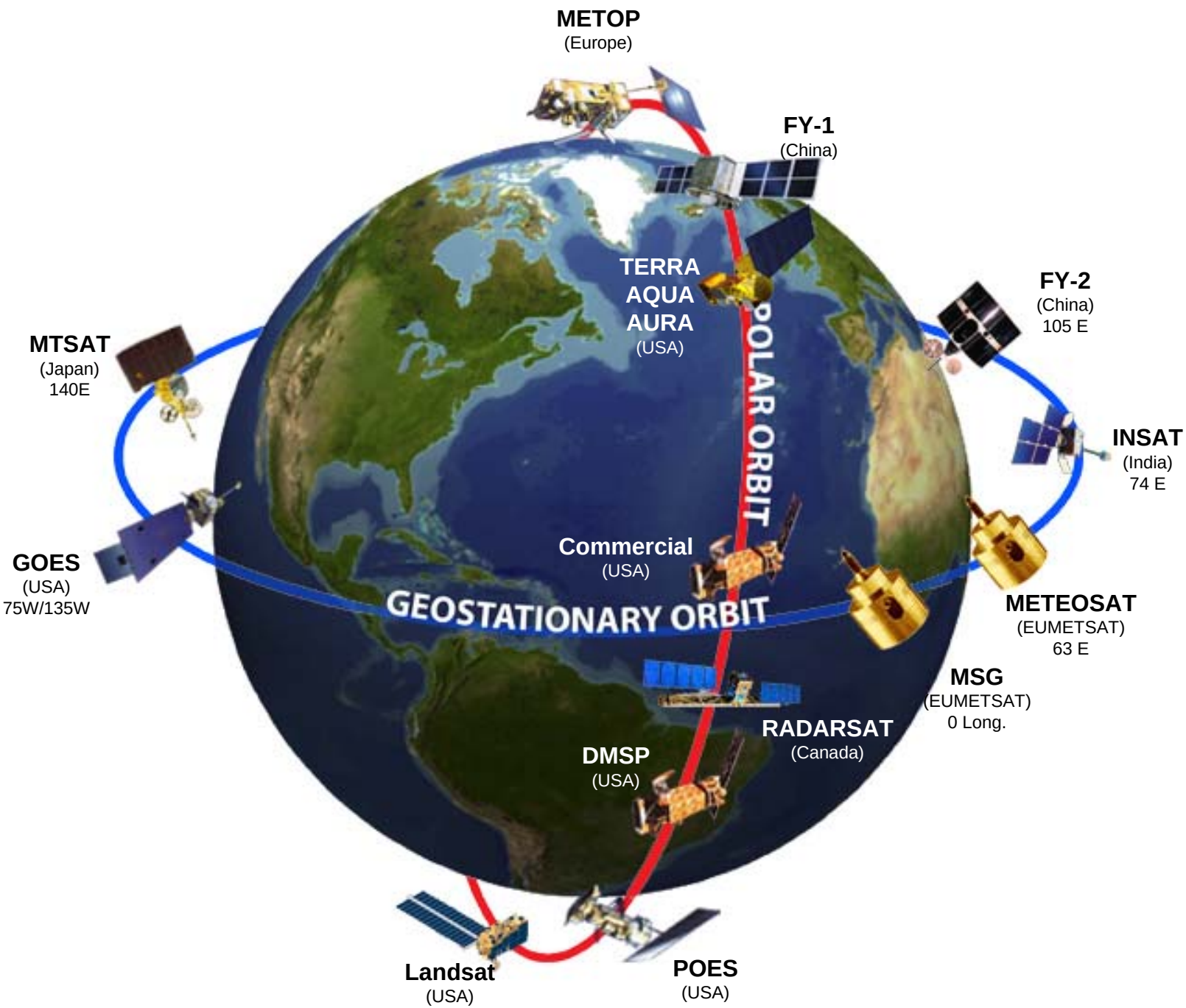
NOAA's Challenge: An Observing System Architecture -- Applied to It's Mission Goals



Global Earth Observation System of Systems (GEOSS)



- **Distributed system of systems** built on current international cooperation efforts among Earth observing and processing systems
- **GEOSS** is:
  - **Comprehensive**—observations and products from all components
  - **Integrated & Coordinated** — leverages contributing members resources
  - **Sustained**—by will and capacity of all members
- **Enables the collection and distribution** of accurate, reliable Earth Observation data, information, products, and services to both suppliers and consumers worldwide—an **end-to-end** process


METOP
(Europe)
FY-1
(China)
TERRA
AQUA
AURA
(USA)
POLAR ORBIT
FY-2
(China)
105 E
MTSAT
(Japan)
140E
INSAT
(India)
74 E
GOES
(USA)
75W/135W
Commercial
(USA)
GEOSTATIONARY ORBIT
METEOSAT
(EUMETSAT)
63 E
MSG
(EUMETSAT)
0 Long.
RADARSAT
(Canada)
DMSP
(USA)
Landsat
(USA)
POES
(USA)

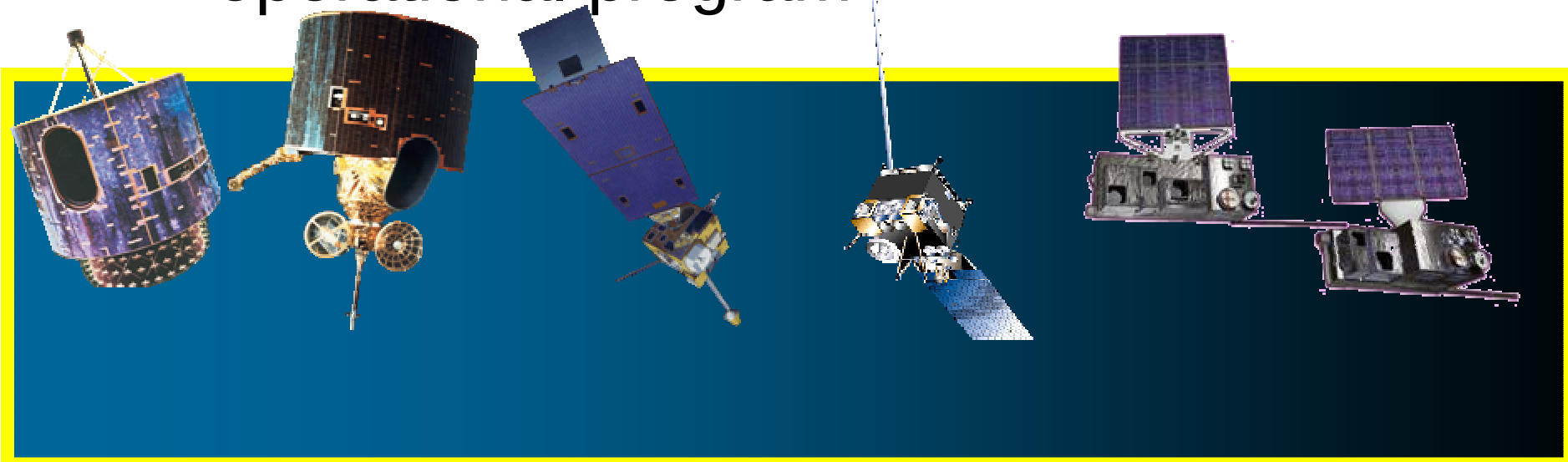
Global Earth Observing System
Attribute: Comprehensive

- Consists of physical, chemical, biological systems
- Encompasses *in situ,* mobile, airborne and satellite observations
- Includes broad range of spatial and temporal scales
  - Global to local
  - Years to minutes

Global Earth Observing System
Attribute: Sustained

- Consists of future, current, and predecessor systems

- Includes sustained R&D program feeding into evolving long-term operational program

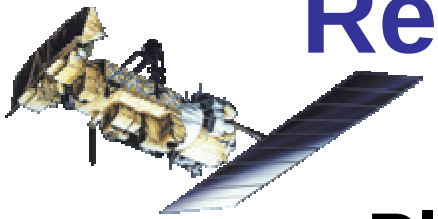


Global Earth Observing System

Attribute: Integrated

Multiple Platforms Orchestrated to Serve One or More Missions

Fused and Merged Products to Meet the Increasing Accuracy of User Requirements



Result: Integrated Systems

Acting As **One**

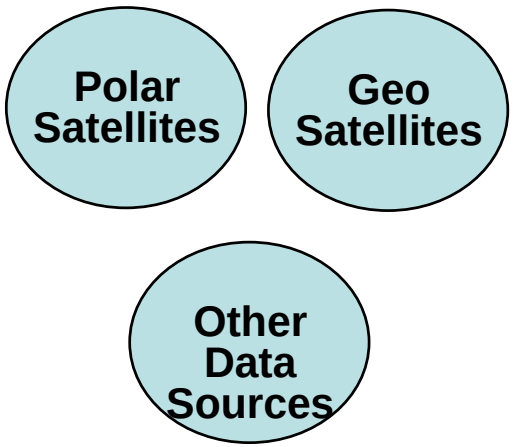
Platform Serving Multiple Missions

Goal - Transition Products from Individual Satellites to a "System of Systems"

DATA

MORE EFFICIENT

Today

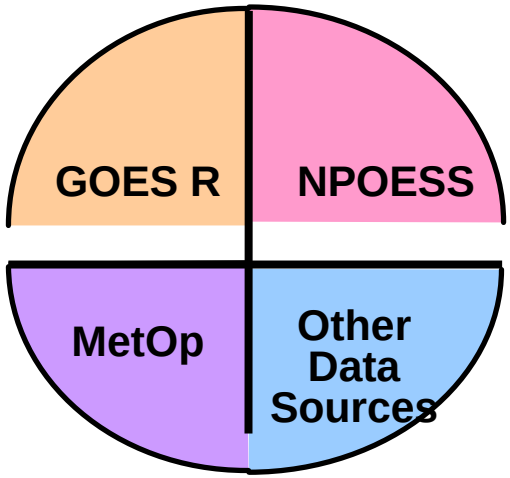


Generate Environmental Products from Independent Observations

INFORMATION

MORE EFFECTIVE

2008-2016

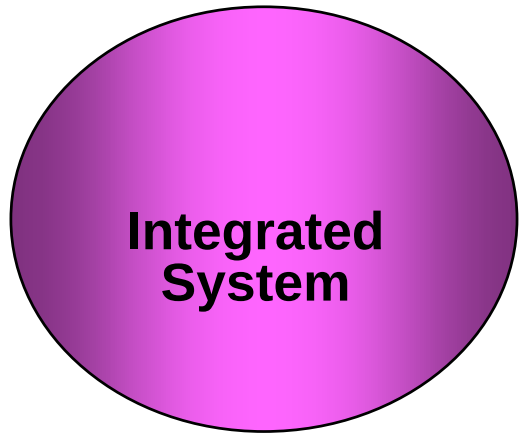


Formulate and Integrate Multi-Platform Environmental Products

KNOWLEDGE FOR DECISION-MAKING

MORE SUSTAINABLE

2020+



Produce Fused, Integrated & Merged Products as One Integrated System

Steps to Integrated Products & Systems

- **Integrated Sensors**:

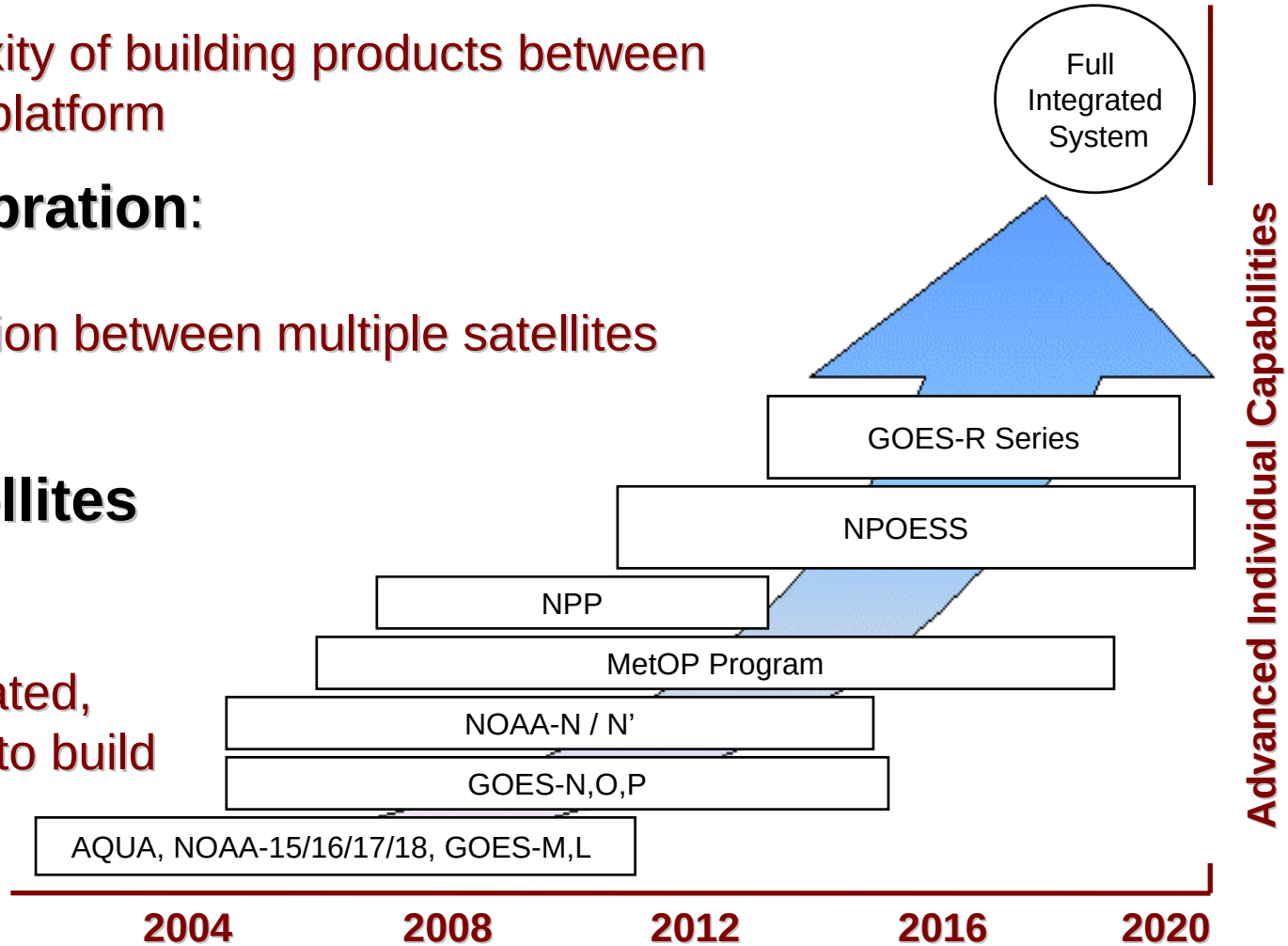
Simplify the complexity of building products between instruments on one platform

- **Integrated Calibration**:

Evaluate the calibration between multiple satellites at different orbits

- **Integrated Satellites Databases**:

Use the cross-calibrated, collocated data sets to build enhanced products



National Architecture For Earth Observations

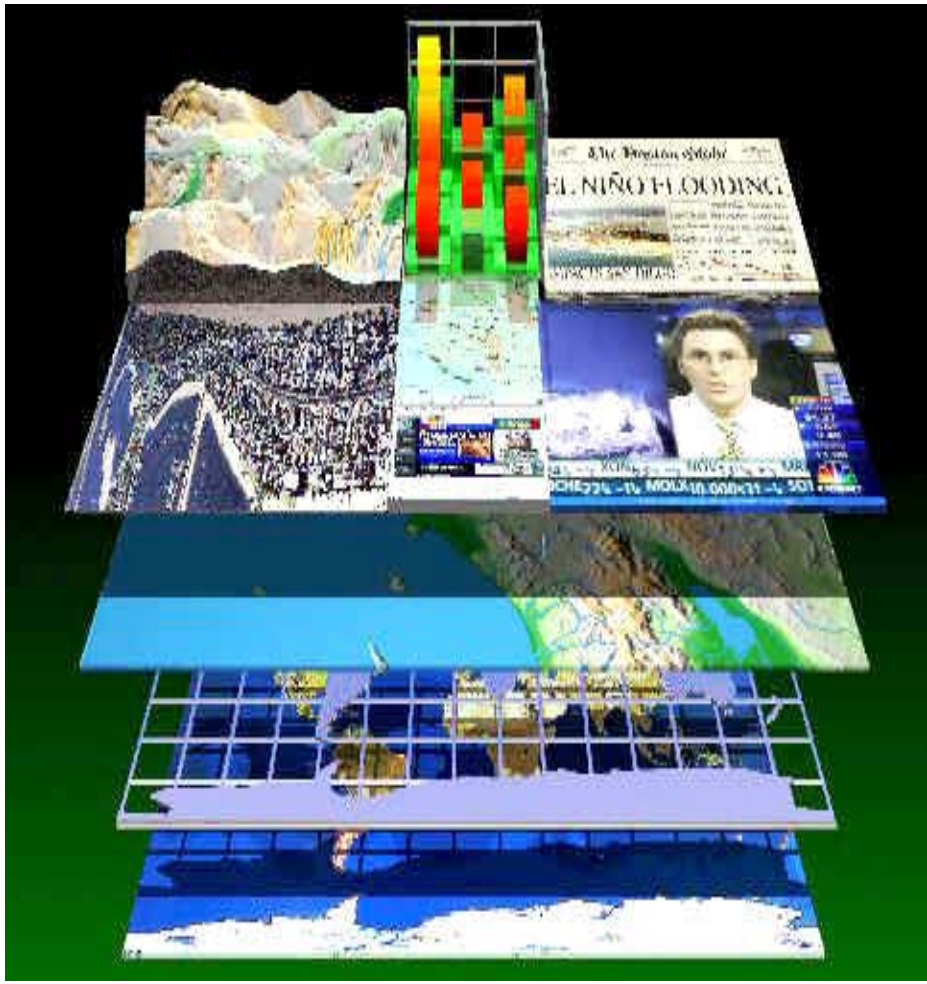
ARCHITECTURE:

- Builds on existing systems
- Addresses planned, research and operational systems
- Interfaces capabilities through interoperability specifications
- Preserves continuity of observations

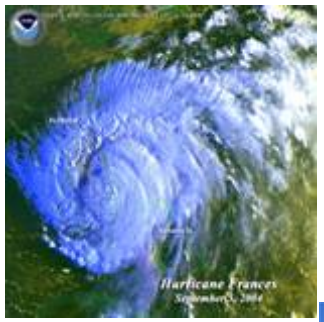
National Data Management System For Earth Observations

DATA MANAGEMENT:

- Current systems already challenged
- New systems mean a 100-fold increase in data
- Development of systems access
- Integration through interoperability



Societal Benefits of Earth Observations



Natural & Human Induced Disasters

Water Resources

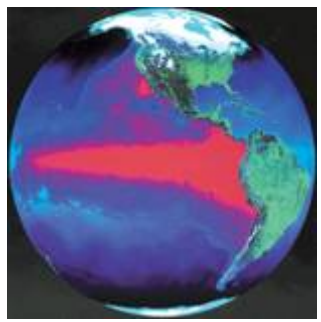
Ecosystems

Human Health & Well-Being

Energy Resources

Sustainable Agriculture & Desertification

Weather Information, Forecasting & Warning



Climate Variability & Change

Oceans

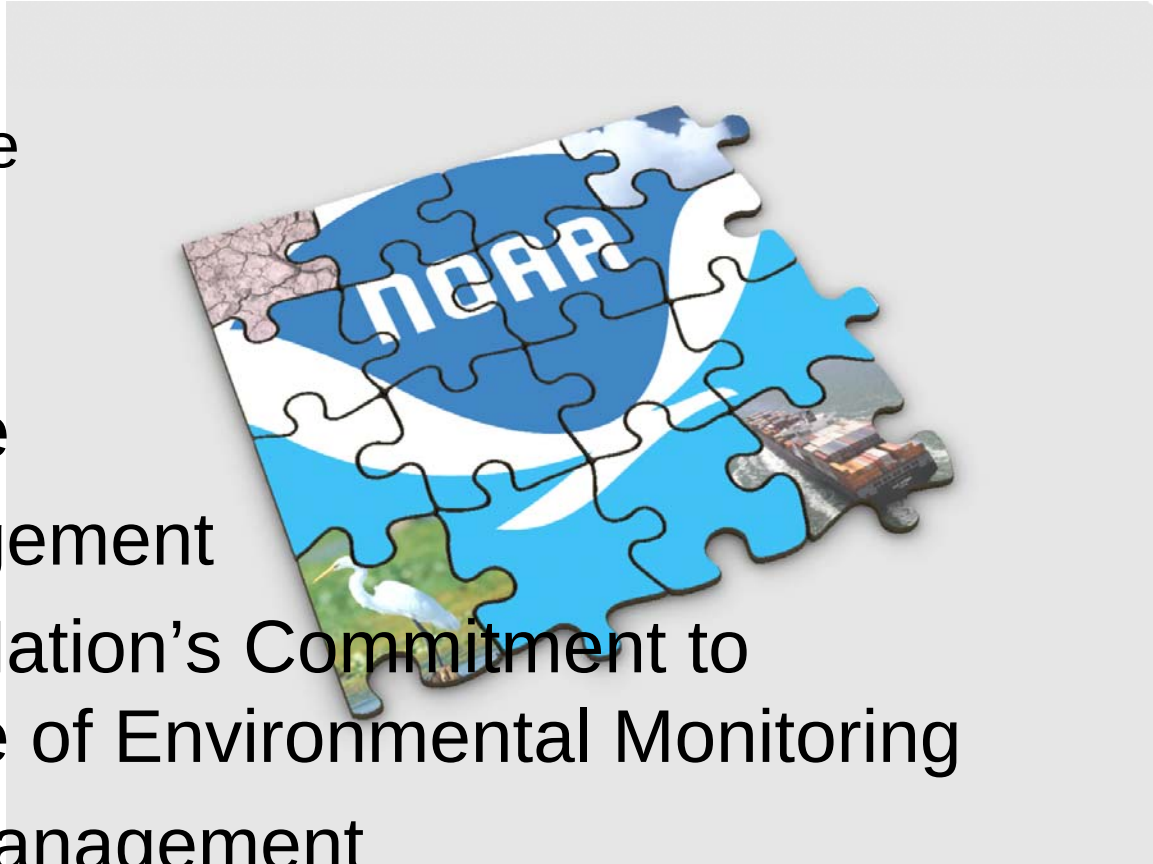
Associated ‘Impact’ Issues

- Homeland Security/Defense
- Water Resource Management
- Global Warming
- Earth Resource Management
  - ‘Feeding the world’
  - Sustaining the planet (deforestation, burning, drought)
  - Harvesting the ocean
- Social Reform & ‘Small World’ Policies
- Climate Change
- Policy & Treaty Negotiations (Kyoto and similar)

Summary

Pulling the Pieces Together…

- GEOSS
  - Comprehensive
  - Integrated
  - Sustained
- SoS Architecture
- Env Data Management
- NOAA and the Nation's Commitment to Improving the Use of Environmental Monitoring
- 'Impact' Issue Management



Future Emphasis Areas

The Next 25 Years

Science

- Hyperspectral data
- Use of multiple satellites & sensors together (merged products)
- Use of ancillary data (elevation, soil type, etc.)
- Ocean parameters (SST, salinity, ocean color)
- Use of spectral solar irradiance in forecast models
- Coupling upper & lower atmosphere (initialization up to 500 km)
- Climate emphasis
- Quantification and distribution of moisture
- Tropical Met issues
- Microwave on GEO
- Scatterometry and Altimetry
- Millimeter wave measurements
- Polarization/polarimetry measurements
- Aerosols determination
- Atmospheric constituents (CO2, CO, etc) & air quality
- Carbon cycle
- Data assimilation
- Improved radiances and vertical profiles
- Improved radiative transfer code
- Surface characterization

Future Emphasis Areas

The Next 25 Years

- Policy
  - Increased use of ‘ops baseline’ in transition
  - Stronger ocean emphasis
  - Faster science into ops
  - Quasi-ops use of prototype (NASA) & Intl sensors
  - Data assimilation (Nation’ s choice of investments)
  - Surface spectral characteristics (Urban planning, bioburning, etc)
  - Increasing impacts of ‘scale’ (space, time, spectral)
  - Emphasis on ‘applied science’
  - GEOSS

Future Emphasis Areas

The Next 25 Years

- Architecture
  - Single-threaded to Cascading (multi-threaded) algs
    - On-demand processing
  - Infrastructure ‘limitations’ (ops systems, compilers)
  - Improved science into ops processes
    - ‘Ops baseline’ issue
    - Testing and validation
  - Interaction with NOAA and other agencies
  - Evolving data access