NOAA Environmental Observation Requirements Collection

February 9, 2005

NOAA IUAOS/Climate Workshop I

Pamela Taylor, NOAA Observation Requirements
Overview

• Background of:
  - NOSC: NOAA Observing System Council
  - NOSA: NOAA Observing System Architecture
    - CORL: NOAA Consolidated Obs Req List
• CORL Requirements Collection Process/Status
• CORL and IUAOS/Climate
Background - NOSC

• Why
  – May 2002: NOAA Program Review Team Recommendation #32
    • Develop a NOAA Observing Systems Architecture (NOSA) to assess current capabilities and identify short-term actions
    • Base prospective observing systems on validated requirements, consistent with a target architecture, and address data utilization and archive
    • to transition requirements identification from stove-piped, technology-driven, platform-oriented to integrated, user needs-driven, mission-oriented
    • Conduct a systemic review of all other observing systems
  • NOAA Strategic Plan
    • Develop integrated global environmental observation and data management system
Background: NEC Decisions

- Establish Observing Systems Council
- Establish NOAA Observing Systems Architect
- Matrix managed within NESDIS
- Implement observing systems architecture toolset across NOAA
- Document baseline NOAA Observing Systems Architecture (NOSA)
- Develop target (10-20 years) NOSA
NOAA Observing Systems Council (NOSC)

- Principal advisory body to the Under Secretary for NOAA’s Earth observation and data management (end-to-end) activities
- Principal coordinating body to White House Committee on Environment and Natural Resources (CENR) Subcommittee on Earth Observations
- Membership
  - Co-Chaired by AA NESDIS and AA NWS
  - AA representatives from each Line Office and appropriate Program leads
NOSC (cont’d)

- **Function**
  - Reviews observing system requirements
  - Analyzes architecture alternatives and risks
  - Recommends acquisition of appropriate observing systems to meet NOAA, national, and international architecture requirements
  - Coordinates NOAA’s participation in national and international earth observation efforts
  - Provides corporate oversight of NOAA Observing Systems Architect (NOSA)
Further Benefits to NOAA

- Provides integrated view of NOAA’s observing systems linked to mission requirements
- Provide framework for future requirements & costs
- Reveal how changes in funding levels for one system will impact many others
- Reveals gaps and duplication
- Results in more cost-effective overall observation system
- Facilitates accessibility to all NOAA observations by all NOAA customers
- Facilitate partnering at all levels
- Identify opportunities for migration of research to operations
Overview

NOSC
Withee/Johnson

NOSA
E.Miller

OS Inventory
(OS Capabilities)
E.Miller

CORL
(NOAA Obs Needs)
P.Taylor

Gap Analysis
Target Architecture
Investment Analysis Recommendations

31 Programs
Observing System Architecture

- Owners, operators, support and personnel
- Higher Systems
- Control
- Strategic Goals
- Platforms and Stations
- Observing Systems
- Geography
- Environmental Parameters
- Environmental Phenomena
- Stakeholder and User
- Data Handling System
- Observation Control System
- Business Process
- Environmental Process
- Requirements
- Observing System
- Location
Requirements Gap Analysis leading to a Target Architecture

Mission Goal

Program

Capabilities

Task/Activities

Serve Society’s Needs for Weather and Water Information

Environmental Modeling

Weather & Water Forecasts and Warnings

Ecosystem Modeling

Measure SST

Measure Wave Height

Measure Water Column Temperature

Gap Analysis

Trade Study or Solutions Analysis

Target Architecture

NOSA Baseline

Task/Activity

SST

SST

SST

Programs or Capabilities that Support Goals

NPOESS

OAR TAO

NWS MAN
## Observing System Gaps in SST Requirement

<table>
<thead>
<tr>
<th>Observational Requirement</th>
<th>User</th>
<th>Priority</th>
<th>Threshold Coverage</th>
<th>Horizontal Resolution</th>
<th>Mapping Accuracy Units</th>
<th>Measurement Range Units</th>
<th>Measurement Accuracy Units</th>
<th>Sampling Interval</th>
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<tbody>
<tr>
<td>Sea Surface Temps: Hemispheric</td>
<td>NWS/NC EP/OPC</td>
<td>1</td>
<td>Threshold Hemispheric</td>
<td>2 kilometers (km)</td>
<td>1.5 degrees Kelvin (K)</td>
<td>271 to 313 degrees Kelvin (K)</td>
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<td>NWS/NC EP/OPC</td>
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<td>NESDIS-EMSP-Sea Surface Temperature</td>
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<td>0.55 km</td>
<td>6.55 km</td>
<td>OLS: 3.7-9.3 km</td>
<td>%RH: 180 to 310</td>
<td>+/- 2</td>
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<td>0 km</td>
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<td>cm-3</td>
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<td>0 km</td>
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<td>2 km</td>
<td>degrees Kelvin (K)</td>
<td>273 to 308</td>
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<td>NESDIS-NPOESS-Sea Surface Temperature</td>
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<td>NESDIS-POES-SST</td>
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<td>Global</td>
<td>1-100 km</td>
<td>Mapping accuracy is 1-6 km, although the necessary threshold is 1.3</td>
<td>Degrees Celsius</td>
<td>-2 degrees Celsius (typically)</td>
<td>within 0.5 degrees Celsius (typically)</td>
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<td>OAR-Argo-OceanTemp</td>
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Notional Portfolio Analysis Result

Cost and “Benefit” of example portfolio

Non Monetized “Benefit”

Example portfolio

Cost

E=76.27, C=383000

Checked options are included in example portfolio

- System A
- System A Expanded
- System B
- System B Expanded
- System C
- System C Upgraded and Expanded
- System D
- System E
- External data
- System F
- System G
- System H
- System I
- System J
- System J Upgraded
- System K
- System K Expanded
- System L
- System L Expanded
- System M
NOSA Near Term Tasks

• Therefore, first step in developing NOSA, is to identify and document all NOAA Observational Requirements
  – Develop a more formal NOAA Observation Requirements Collection Process
  – Produce a NOAA Consolidated Observation Requirements List (CORL) database

• Provide PR08 efficiency and investment recommendations
  – Objective: Provide NOAA Leadership with information to assist in building a NOAA-wide portfolio of observing system investments
  – Optimal portfolio: the combination of observing system investments that provides the greatest value within a given budget (recognizes legal mandates and other drivers)

• Goal: Develop repeatable process to support '08 PPBES cycle and beyond
**CORL: Background**

**Scope**
- Initial focus on supporting a NOAA-wide observing system architecture (for 4 NOAA Goal Teams/31 NOAA Programs) that allows central planning, system integration
- Plan to be part of an integrated global environmental observation and data management system

**How**
- **7-Step Process**: From Observation Requirements Identification, Translation and Standardization through Validation and Annual Updating
Observational Requirements Collection
Process Description – 7 Steps

1. **Identification and Collection** – current documentation

2. **Translation and Standardization** – MORL/GCMD

3. **Revision and Prioritization** – by program

4. **Validation** – by parameter, attribute, approval levels

5. **Consolidation** – all MORLs to CORL

6. **Interfaces** – with NOSA and PPBES

7. **Maintaining Currency** – annual Review of Req, Jan-Feb prior to NOAA PPBES cycle
Requirements Process - Past

- **Level**: Agency
  - Process: NWS
  - Characteristics: Limited NOAA-wide requirements collection
- **Level**: System
  - Process: POES
  - Process: GOES
  - Characteristics: Requirements are system-, not agency-, based
  - Characteristics: No formal translation of requirements to product processing, distribution, archive and assimilation
Requirements Identification to Systems Allocation

Consolidated Observation Requirements

Architecture Development

Trade Studies

International Systems

Other Federal Systems

Commercial Systems

Interagency Requirements Collection Process

Research and Academic

Media and Commercial

Meteorological Centers

International Partners

External Requirements Collection Process

System K

System N

System L

System O

System M

System F

System I

System G

System D

System C

System E

System J

System H

System B

System A

Data Collection

Product Generation

User Assimilation
# NOAA Mission Goal Teams

<table>
<thead>
<tr>
<th>Ecosystem Goal</th>
<th>Climate Goal</th>
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<tbody>
<tr>
<td><strong>Habitat</strong></td>
<td><strong>Climate Observations &amp; Analysis (3)</strong></td>
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<td><strong>Corals</strong></td>
<td>- <strong>Atmosphere</strong></td>
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<td><strong>Coastal and Marine Resources</strong></td>
<td>- <strong>Ocean</strong></td>
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<tr>
<td>Protected Species</td>
<td>- <strong>Land</strong></td>
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<td>Fisheries Management</td>
<td><strong>Climate Forcing</strong></td>
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<td><strong>Aquaculture</strong></td>
<td><strong>Climate Predictions &amp; Projections</strong></td>
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<td>Enforcement</td>
<td><strong>Climate &amp; Ecosystems</strong></td>
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<td><strong>Ecosystem Research</strong></td>
<td>Regional Decision Support</td>
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<td><strong>Ecosystem Observations (9)</strong></td>
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<td><strong>Weather and Water Goal</strong></td>
<td><strong>Commerce and Transportation Goal</strong></td>
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<td><strong>Local Forecasts and Warnings</strong></td>
<td><strong>Marine Transportation Systems</strong></td>
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<td><strong>Space Weather</strong></td>
<td><strong>Aviation Weather</strong></td>
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<td><strong>Hydrology</strong></td>
<td><strong>Marine Weather</strong></td>
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<td><strong>Air Quality</strong></td>
<td><strong>Geodesy</strong></td>
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<td><strong>Environmental Modeling</strong></td>
<td>NOAA Emergency Response</td>
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<td>Science, Technology, and Infusion</td>
<td>Commercial and Remote Sensing Licensing</td>
</tr>
<tr>
<td><strong>Coasts, Estuaries and Oceans</strong></td>
<td><strong>Surface Weather</strong></td>
</tr>
</tbody>
</table>

Programs with observational requirements are in red italics.

*(x) = number of SubPrograms*
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Obs Reqs Disciplines and Attributes

**Disciplines**
- Atmosphere
- Radiance Or Imagery
- Land Surface
- Solid Earth
- Cryosphere
- Biosphere
- Oceans
- Hydrosphere
- Human Dimensions
- Sun-earth Interactions

**Attributes**
- User Info (POC, Phone, Email)
- Observational Requirement
- Observational Requirement Priority
- Global Climate Master Change (GCMD): Topic/Discipline, Term, Variable
- Observational Requirement Type: Biological, Chemical, Physical
- Timeline
- Threshold/Objective
- Geographic Coverage
- Vertical Range
- Vertical Resolution
- Horizontal Resolution
- Mapping Accuracy
- Measurement Range
- Measurement Accuracy
- Measurement Precision
- Sampling Interval
- Data Latency
- Long-Term Stability
- Associated NOAA Program Outcome
Observational Requirements Collection

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Prioritization – 2 Levels

1) Parameter Prioritization

Priority 1 – Mission Critical
Priority 2 – Mission Optimal
Priority 3 - Mission Enhancing

2) Example Attribute Prioritization

<table>
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<tr>
<th>Goal</th>
<th>Geo Cov</th>
<th>Vert Res</th>
<th>Horz Res</th>
<th>Msmnt Acc</th>
<th>Msmnt Pre</th>
<th>Samp Int</th>
<th>Data Lat</th>
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<tr>
<td>W&amp;W</td>
<td>CONUS</td>
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<td>1</td>
<td>1-2</td>
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<td>1</td>
<td>1</td>
<td>3</td>
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<td>CLI</td>
<td>Global</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>1</td>
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Observational Requirements Collection

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Significant Milestones

• **Spring 2004**
  – Translated NOAA LO requirements to NOAA Program needs
  – Defined naming convention; standardized template schema
  – Developed 27 draft MORLs

• **Summer 2004**
  – Incorporated and updated with FY07 Program Baseline Assessments
  – Developed phased-approach schedule for CORL publication in Spring 2005

• **Fall 2004**
  – Completed Phase 1 identification of *Priority-1* observation requirements and *Threshold level* attributes
  – Transitioned over 1400 Obs Reqs (67K attribute values) from Program Excel spreadsheets to on-line relational (CasaNOSA) database

• **Winter 2004-2005**
  – Uploaded all Phase 1 Draft MORLs to NOSA Web site
  – Data Call for Phase 2 (Priority 2&3, Threshold & Objective Levels)

• **Planned April May 2005**
  – Generation of first CORL representing 31 NOAA Programs
NOAA Observing Systems Architecture (NOSA)


Site Information

- About NOSA
- About Architecture
- Observing System Inventory
- Relationship to PPBEs
- NOAA Programs and Environmental Observation Requirements
- Observation Requirements vs System Capabilities Tool
- How is NOSA used?
- Target Architecture
- Strategic Direction (pdf)
- NOAA Observing Systems Council (NOASC)

Featured Observing System

OAR/PMEL Fisheries Oceanography Coordinated Investigations (FOCI)

FOCI (NOAA/PMEL and NOAA/AFSC Fisheries-Oceanography Coordinated Investigations) conducts research to better understand the relationship between the marine environment and the survival of commercially valuable fish in the North Pacific, and how climate impacts the ecosystems of the North Pacific. Moorings are an integral part of data collection, and FOCI has been deploying moorings at numerous short- and long-term sites since 1983. PMEL-FOCI moorings produce temperature, salinity, meteorological variables, current velocities, fluorescence, nutrients and other time series parameters in the ocean environment. Studies are focused in the Bering Sea and North Pacific, and encompass large and varying dynamic systems sensitive to change at both regional and global extents.

View FOCI Stations: Map Station List

Other Observing Systems

Select an Observing System

- NOSA Geospatial Database Search
- Catalog of NOAA's Observing Systems (PDF)

About NOSA

NOAA initiated its first-ever comprehensive review of all its observing systems and their interrelationships. This activity was termed the baseline NOAA Observing System Architecture (NOSA).

The baseline NOSA was constructed with the assistance of all observing system managers, research and operational, within NOAA.

More about NOSA

A Spatial Portal to NOAA's Observing Systems (presentation at the 2004 AGU Meeting)
<table>
<thead>
<tr>
<th>Observing System</th>
<th>Acronym</th>
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<tbody>
<tr>
<td>NASA-QuikSCAT</td>
<td>QuikSCAT</td>
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<td>NESDIS-Geostationary Operational Environmental Satellite 1-M</td>
<td>GOES-1/M</td>
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<td>NESDIS-Geostationary Operational Environmental Satellite NOP</td>
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<td>NESDIS-Marine Optical Buoy</td>
<td>MOBY</td>
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<td>NESDIS-National Polar-orbiting Operational Environmental Satellite System</td>
<td>NPOESS</td>
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<td>NESDIS-National Polar-orbiting Operational Environmental Satellite System Preparatory Project</td>
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<td>NESDIS-Polar Operational Environmental Satellite</td>
<td>POES-1/M</td>
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<td>NOS-Continuously Operating Reference Stations</td>
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<td>NWLON</td>
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<td>NOS-Physical Oceanographic Real-Time System</td>
<td>PORTS</td>
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<td>NOS-System-Wide Monitoring Program</td>
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<td>NWS-Automated Remote Collector</td>
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Observational Requirements Database

Requirements to Observations

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*For Priority Categories:

1 = Mission Critical / Cannot meet operational mission objectives without this data
2 = Mission Optimal / Data not critical but would provide significant improvement to operational capability
3 = Mission Enhancing / Needed to enhance state of knowledge / assess potential for operational capability
CORML Matrix Template & IUAOS/Climate

• Tool for your use to capture your group’s consensus, platform-independent Obs Reqs needs to meet your mission

• Entries to consider from NOAA Climate/COA and Climate/CF

• Entries to consider from GCOS

• Flexibility – add columns, stratification (GEO, VR, Temporal) and/or comments to capture your group’s Obs Reqs
  – Change of Attribute = new requirement

• Enables ability to interface with all other NOAA Goal/Program Obs Reqs

• Enables ability to interface with NOAA Gap, Target Arch and Investment Analyses

• Consistency with GCOS, IWGEO, NOAA Climate/COA & CF and W&W/AQ, Hydro, EMP & LFW……