



Naval Oceanography R&D Needs

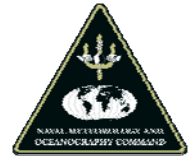
*Presentation to CEROS Industry Day
October 2008*

James Rigney
Naval Oceanographic Office
Chief Scientist (OTT)
james.rigney@navy.mil
228-688-4136

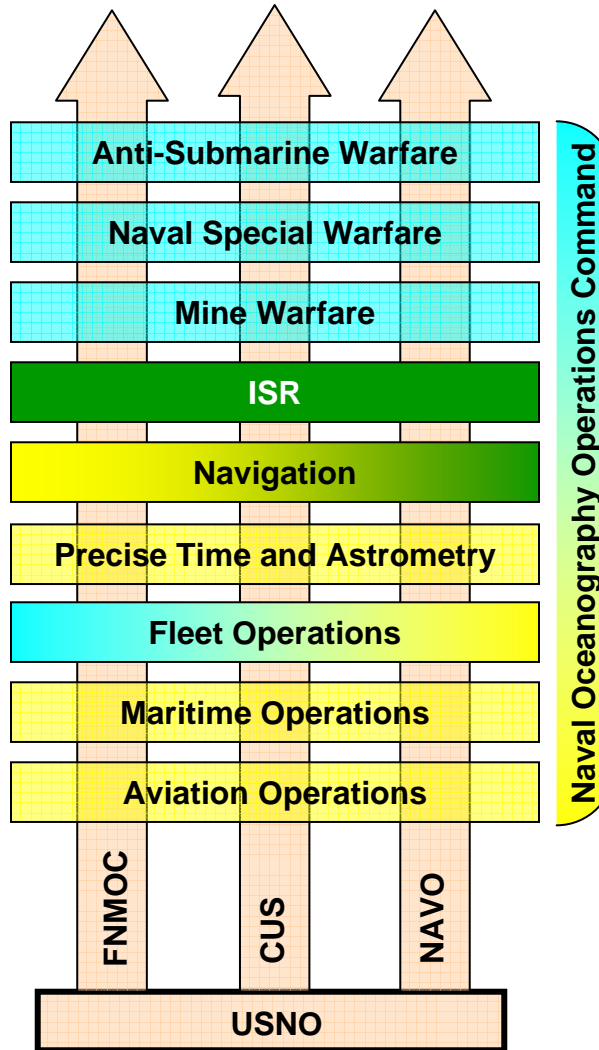
Steve Lingsch
Naval Meteorology & Oceanography Command
Assistant Chief of Staff
Technology Transition & Integration (N9)
stephen.lingsch@navy.mil
228-688-4779



Naval Oceanography



WARFIGHTING FOCUSED



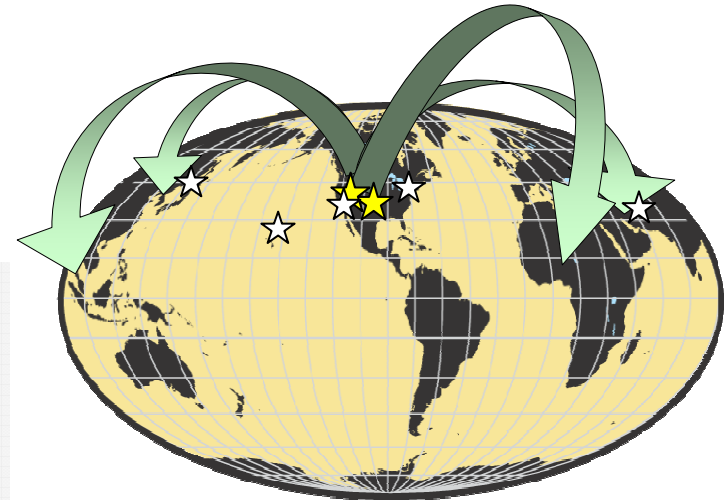
Naval Oceanography Operations Command

Naval Oceanography

- ~\$600M operating budget
- 12 ships
- 1,950 military
- 1,350 civilians

- Warfighting
- Safety
- Shaping

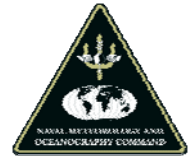
KNOWLEDGE-CENTRIC



- **Teamwork**
- **Technical Excellence**
- **Clear Communications**
- **Manage Risk**
- **Measure Results**
- **Continuous Improvement**



Battlespace on Demand



Tier 3 – the Decision Layer

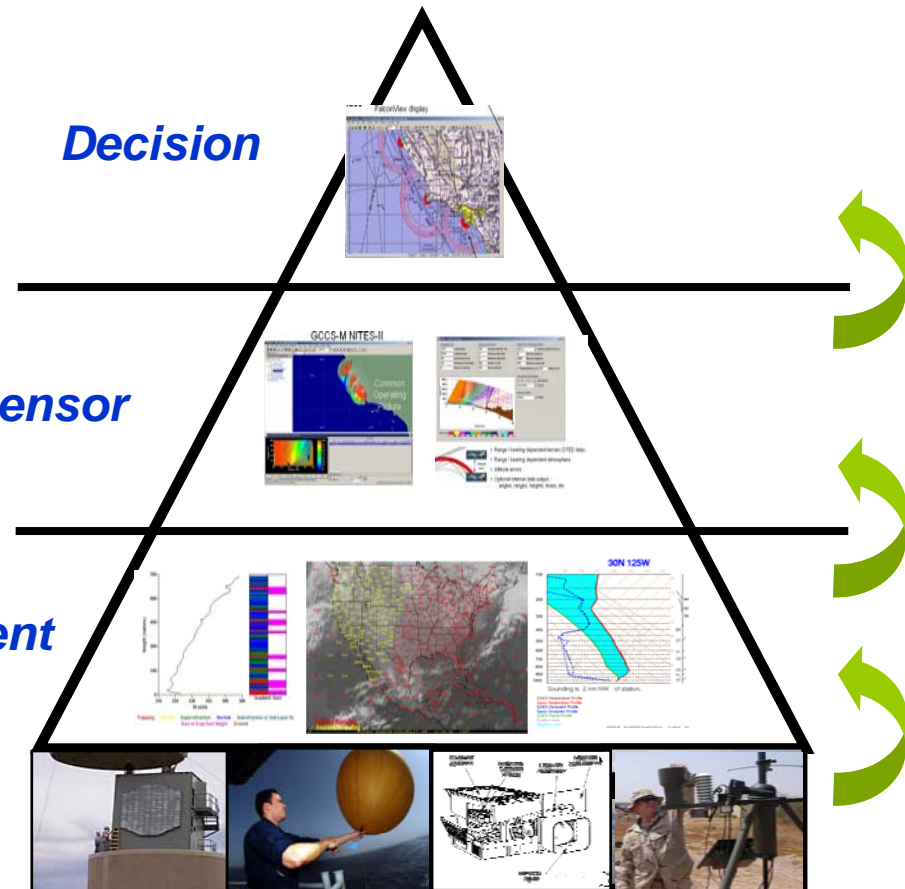
- Options / Courses of Action
- Sensor Employment
- Asset Allocation / Timing
- Quantify Risk

Tier 2 – the Sensor Performance Layer

Tier 1 – the observed and forecast Environment Layer

Environment

Data

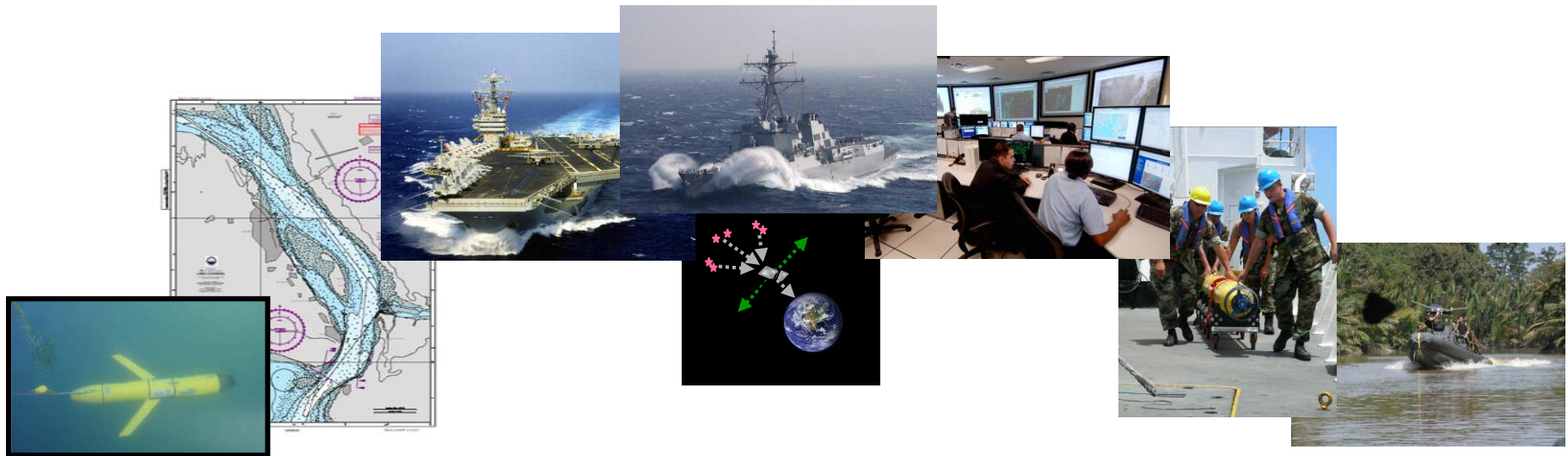
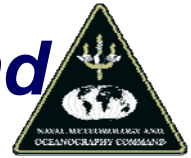


Initial and Boundary Conditions

We must make better decisions faster than the adversary



Naval Oceanography Operations Command



- ***Small embedded Military footprint forward***
- ***Reachback to Production Centers - 24/7***
- ***Tightly integrated Civilian / Military teams leveraging Expertise, Knowledge, and Experience***

Bring resources of the entire Enterprise to provide strategic, operational and tactical oceanographic, riverine, and atmospheric decision superiority to U.S. and coalition forces



Integrated Undersea Surveillance System (IUSS)



Commander, Undersea Surveillance

- ISIC for NOPFs & JMF
- Operational reach-back (CUS N2)
- System Quality Assurance

Naval Ocean Processing Facility Whidbey Island WA

- Ocean Surveillance in 3rd & 7th Flt AORs
- SURTASS Operational Support
- IUSS Sea Component West (MILDET)
- Partnered with Canadian Navy

Naval Ocean Processing Facility Dam Neck VA

- Ocean Surveillance in 2nd, 3rd, 6th, & 7th Flt AORs
- SURTASS Operational Support

Joint Maritime Facility St. Mawgan UK

- Ocean Surveillance in 6th Fleet AOR
- Partnered with Royal Navy/Air Force
- Remoted to NOPF DN May 2009

Surveillance Towed Array Sensor System (SURTASS) Ships



**USNS IMPECCABLE
(LFA Capable)
USNS VICTORIOUS
USNS EFFECTIVE
USNS LOYAL
USNS ABLE
(CLFA Capable)**



- **24/7/365 Acoustic surveillance of threat submarines and other contacts of interest**
- **Positional information to Theater ASW Commanders and tactical forces**
- **Persistent, fixed and mobile, long-range active and passive acoustic systems with key node redundancy and reach-back capability**

“WE PUT THE CROSSHAIRS ON THREAT SUBMARINES!”

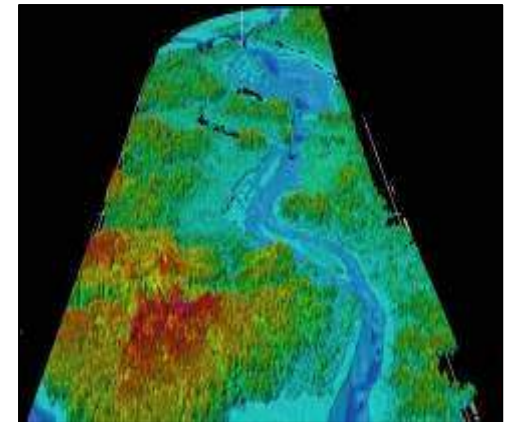


Naval Oceanographic Office



Focused Analysis

- Ocean & Acoustic Modeling
- Bathy Databases
- Geophysical Databases
- Bottom Change Detection



Smart Collection

- T-AGS Survey Ships
- Hydro Survey Launches
- AUVs, Gliders, Buoys
- Satellite Remote Sensing
- Airborne Bathy Lidar & HSI

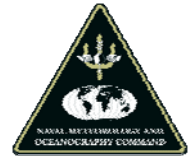


Applies oceanographic knowledge across the full spectrum of warfare
Products, services and consultation available 24 hours a day
Products and services available online
Partnerships with private industry, government organizations and academia





U.S. Naval Observatory

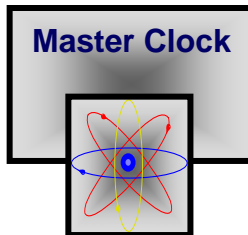
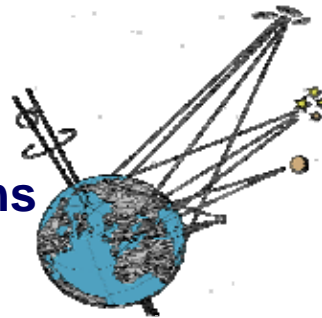


Precise Time

Earth Orientation Parameters

Astrometry – star positions & motions

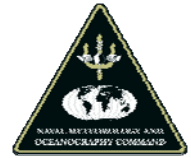
Astronomical Applications



Single DoD source for precise timing and astrometric information for navigation, targeting, weapons guidance, communications, etc.
Conducts research to improve these services, ensuring the U.S. remains the world leader



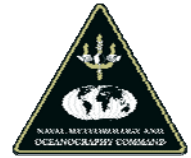
How R&D Transitions to NAVMETOC



- ***O&M,N and OPN funds can be used for purchase of COTS.***
- ***Directly controlled R&D funds are extremely limited.***
- ***We don't do acquisitions.***
- ***Most acquisitions are done via acquisition program managers (e.g. PEO-IWS 5A, PMW-120).***
- ***Many R&D needs are being addressed by performers such as Naval Research Laboratory. If you have ideas that can help, we will encourage you to contact the PEO/PM/Lab.***
- ***Some of the following needs are NOT being addressed via these avenues.***



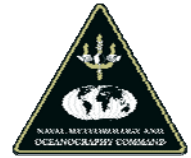
R&D Needs



- *The following slides describe general areas of METOC needs with examples.*
- *The examples are meant to serve as discussion starters for tomorrow's "speed dating" and continued future interaction.*



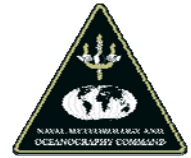
R&D Needs – General Topics



- ***Data Collection***
- ***Ocean Modeling***
- ***Uncertainty***
- ***Visualization***
- ***Decision Support***



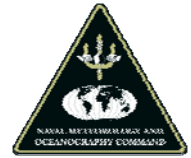
R&D Needs



- ***UUVs - Supporting Technology***
 - ***Batteries - endurance is the key.***
 - ***Navigation and positioning – over long time periods and distance. (~20 nmi & 10 hr)***
- ***Geoacoustic Parameters / Ambient Noise***
 - ***Off-board/remote/autonomous geoacoustic measurements sufficient to support Navy acoustic modeling***
- ***Air-Deployed Tide Gauges***
- ***Expendable (ship- & air-deployed) Transmissometers***



R&D Needs



- ***Multibeam Echosounder Data Correction***
 - *High resolution (space & time) sound speed analysis*
- ***GPS Tide Buoy / Chart Datum Uncertainty***
 - *Estimate the uncertainty in computing local chart datum from short-term GPS tide buoy measurements.*
- ***Uncertainty for Ellipsoid > Chart Datum Conversion***
 - *Seamless integration of bathymetric data which may be on a variety of datums to a common datum*
- ***Sediment/Sub-bottom Classification/Characterization***
 - *Automated algorithms using data from NAVO systems.*



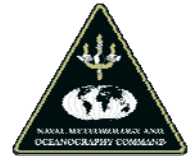
R&D Needs



- **Denied Area Estimates (with Uncertainties)**
 - Bathymetry
 - Currents
 - Waves
- **Remote Sensing**
 - METOC properties (including uncertainties) in shallow water – algorithm development & validation for emerging sensors (e.g. MERIS, World-View 2, NPP, Artemis, Quickbird, etc.)
 - Hyperspectral riverine algorithm development & validation (depth, bottom type, current speed, sediment load)
 - Surf zone
 - bathymetry algorithm development
 - model wave height validation
- **Ocean Optics**
 - Validation of remote sensing algorithms used to derive optical properties in shallow water for emerging sensors (e.g. MERIS, NPP, Artemis, etc.)
 - Cross-calibration/validation of emerging, industry-developed in situ optical instrumentation.
 - Predictive models for forecasting optical properties.



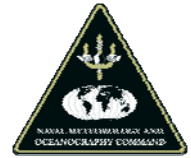
R&D Needs



- **Effective ocean model data assimilation**
 - **Irregular, high sample rate data (e.g. data from gliders)**
 - **Shallow Water Altimetry**
 - **Ocean Model error covariance construction in Navy AOIs**
- **Ocean Model Nesting**
 - **Optimization strategy for nesting as global models become higher resolution.**
 - **Coupling Delft3D with high resolution NCOM models.**
- **Ensemble modeling techniques**
- **Ocean feature modeling techniques for features of high interest (fronts, river plumes, etc)**
- **Smart climatologies constructed from combining historical data, reanalyses/modeling**



R&D Needs



- ***Sonic Layer Depth Forecasts – what is the most accurate and effective way of predicting sonic layer depths?***
- ***Coupled Ocean-Atmospheric-App Models***
 - ***Metrics for optimal coupling of ocean-atmosphere-application (e.g. acoustics) model.***



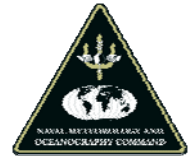
R&D Needs



- ***Uncertainty: Characterize and Communicate***
 - ***Sensor measurement / remote sensing uncertainties***
 - ***GPS Tide Buoy / Chart Datum Uncertainty Analysis uncertainties***
 - ***Uncertainty for Ellipsoid > Chart Datum Conversion***
 - ***Bathymetry grids***
 - ***Modeling & forecasting uncertainties***
 - ***Acoustic probability of detection***
 - ***Near-shore currents***
- ***Sampling Guidance: Where do we deploy sensors in time & space to reduce product / model error?***
 - ***Ocean physics, optics, geoacoustics variables***
 - ***Example: how do we optimally sample for ocean circulation models with horizontal resolutions finer than 3 km?***



R&D Needs



- ***Enhanced visualization of large, time-varying METOC datasets.***
- ***Automated tools for assessing model output by ocean forecasters.***
- ***Rapid environmental assessment/data fusion tools for the METOC professional.***



R&D Needs



Decision Support Tools:

Moving from
Tier 2 to Tier 3

Information from Tier 2
Performance Surfaces must
be cascaded into timely and
accurate Tier 3 Decision
Support:

- Search plans
- Asset allocation
- Ingress/egress planning
- etc.

