Advanced estimation of Sensor Performance

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Enabling Capability #2: Characterize the Battlespace

- **Goal of Enabling Capability:**
  - Leverage "through-the-sensor" in-situ measurements
  - Improved common models, in-situ measurements, and environmental databases enable tactically useful planning and performance assessments

- **FNC Investment Plans:**
  - Cross-Platform Data Fusion - Common Tactical Picture (CTP)
    - **Use cross-platform & cross-sensor data to adaptively set sensor thresholds to optimize joint performance**
    - **Demo in FY02**
  - Cross-Platform Data Fusion - Common Environmental Picture
    - **Builds on CTP information to incorporate up-to-date environmental information into sensor performance prediction capability**
    - **Demo in FY05**
  - Sensor Performance Uncertainty Prediction
    - **Capture uncertainty of environmental measurements for adaptive signal processing & sensor performance prediction**
    - **Program start in FY03, Demo in FY07**

Characterize the Battlespace Enabling Capability #2

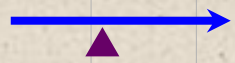
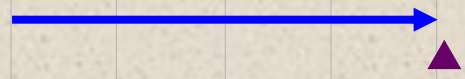
Littoral ASW

Integrated ASW

Goal:

- **Leveraged "Through the Sensor" *In-Situ* Measurements**
- **Improved Common Models *In-Situ* Measurements and Environmental Databases Enables Tactically Useful Planning and Performance Assessments.**

▲ Indicates Final Demo

	Transition To	FY 02 03 04 05 06 07
Content for Common Tactical Picture (CTP) Use cross-platform & cross-sensor data to adaptively set sensor thresholds to optimize joint performance	**ASTO/N76, N77, N78** PE 0603553N POC CAPT Miles Quigley	
Content for Common Environmental Picture Builds on CTP information to incorporate up-to-date environmental information into sensor performance prediction capability Leverages CTP program	**ASTO/N77, N76, N78** PE 0603207N, 0603561N 0604503N, 0604558N 0205620N POC Bob Stock	
Sensor Performance Uncertainty Prediction - Common Tactical/ Environmental Picture Capture uncertainty of environmental measurements for adaptive signal processing & sensor performance prediction. **Builds on ONR"discovery" program**	**ASTO/N76/N77/N78** PE 0603207N, 0603561N 0604503N, 0604558N 0205620N POC Bob Stock, Bob Zarnich	

"NETWORK CENTRIC USW": IASW – Common Environmental Picture

Goals of the LASW FNC CEP Project

- **Demonstrate improved real time, on-the-platform (organic), end-to-end, active and passive, sensor performance estimation**
  - Environmental sensing through-the-tactical sensor and with special purpose environmental sensors
  - Environmental now-casting
  - Source and signal propagation in the environment
- **Demonstrate the value added of improved performance**
  - Single sensor system tracking
  - Fusion of sensor systems on a platform and across platform
  - Common cross platform input to TDAs
  - Input to dynamic data bases

Approach

- **Leverage existing/developing systems and algorithms**
  - EAST, TAMDA, ITWG, N87 studies, PUMA,
- **First stage: Emphasize improvements to platform sensors and sharing of METOC information to improve own platform sensor performance prediction**
  - Measure: Do we have the right data? Is it recent?
  - Use to reduce own platform FAR
- **Second stage: Cross platform sharing of "common sensor performance prediction"**
  - Measure: overall reduction in FAR, improved time to detect, improved hold time, increase effectiveness of platforms

Insights/Conclusions from Limited Network-Centric/ASW C4I "Value-Added" Analysis

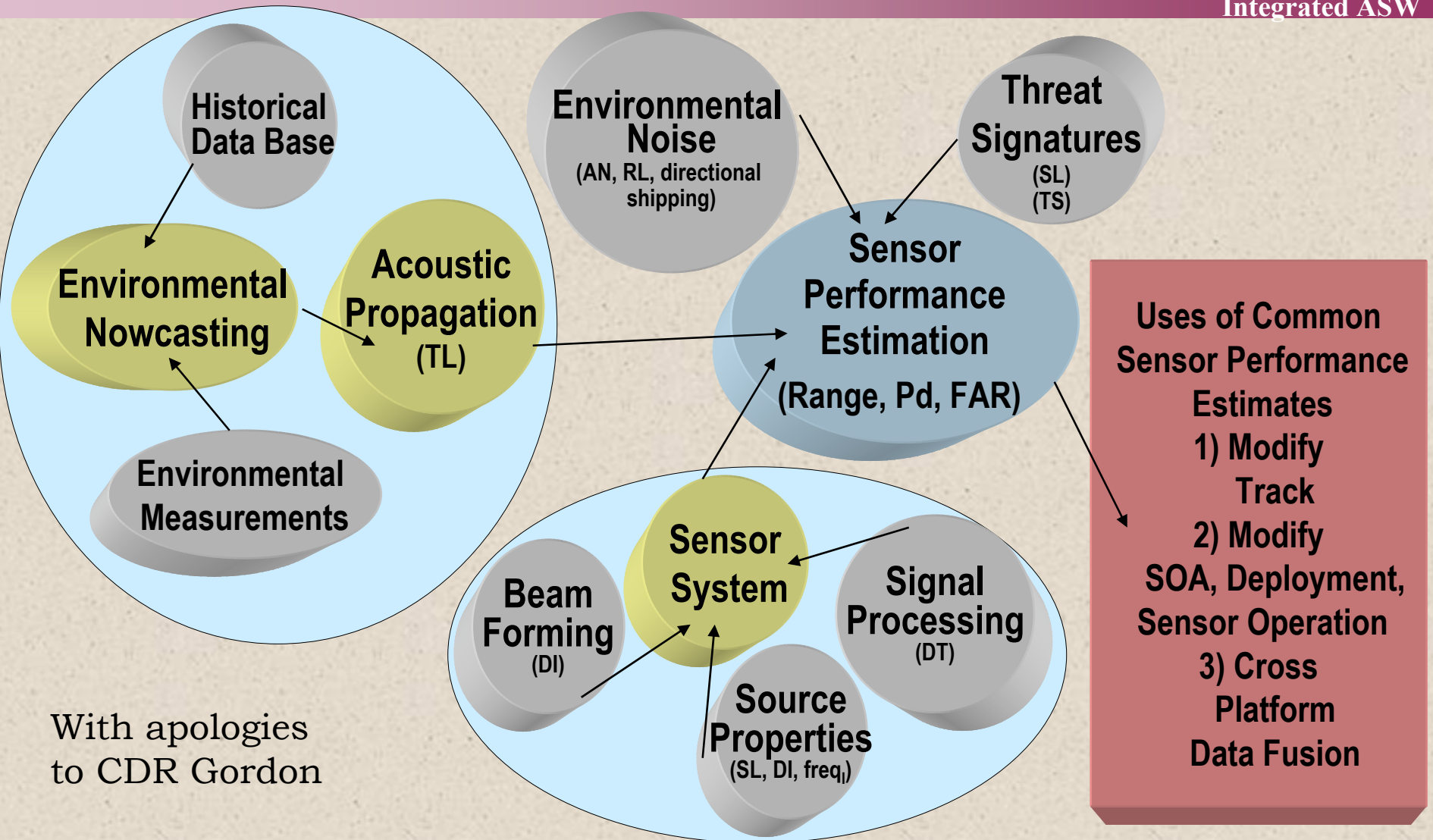
Integrated ASW

*(Only One Tactical Situation & Accounting for Only Some of the Many Potential Benefits)**

- **Quantification of value-added for improved METOC data processing/related TDAs**
  - 10% increase in total valid classifications on adversary submarines (during pre-hostilities)
  - 24% increase in total number of submarines attacked (during initial onset of hostilities/transition to war)
  - 37% increase in ability to deny submarine attacks on units transiting SLOC (hot war phase)
- **Quantification of value-added for sharing/fusing ASW contact information & improved METOC/TDAs**
  - 49% increase in total valid classifications on adversary submarines (pre-hostilities)
  - 39% increase in total number of submarines attacked (transition to war)
  - 68% increase in ability to deny submarine attacks on units transiting SLOC (hot war)
- **Quantification of value-added for remote monitoring of sensor fields (i.e., freeing up manned aircraft for tracking OPS), contact sharing & improved METOC/TDAs**
  - 79% increase in total number of submarines attacked (transition to war)

*"Network-Centric/ASW C4I Issue Characterization", J. Benedict et.al, 1999.

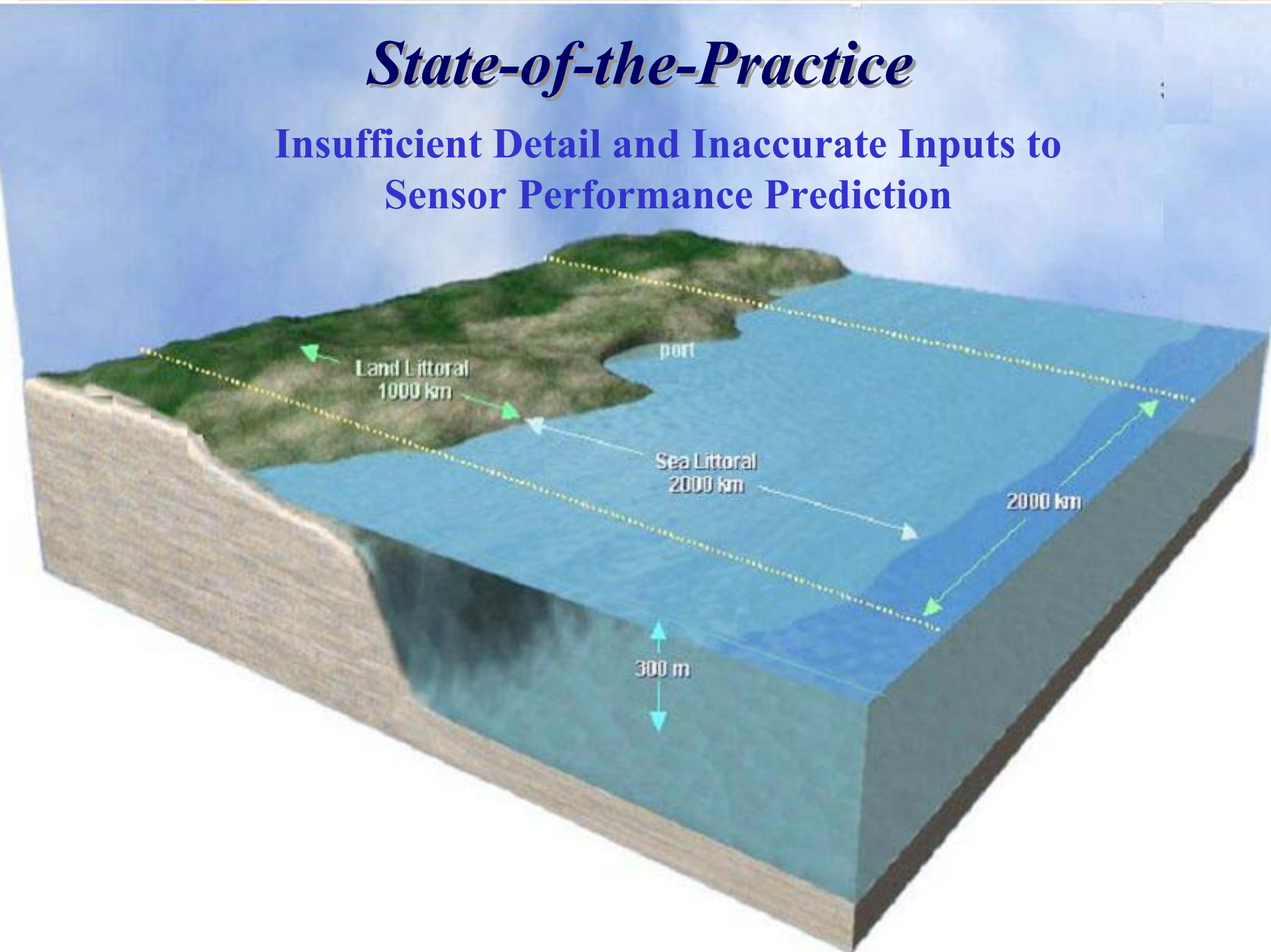
Elements of Tactical Acoustic Sensor Performance Estimation



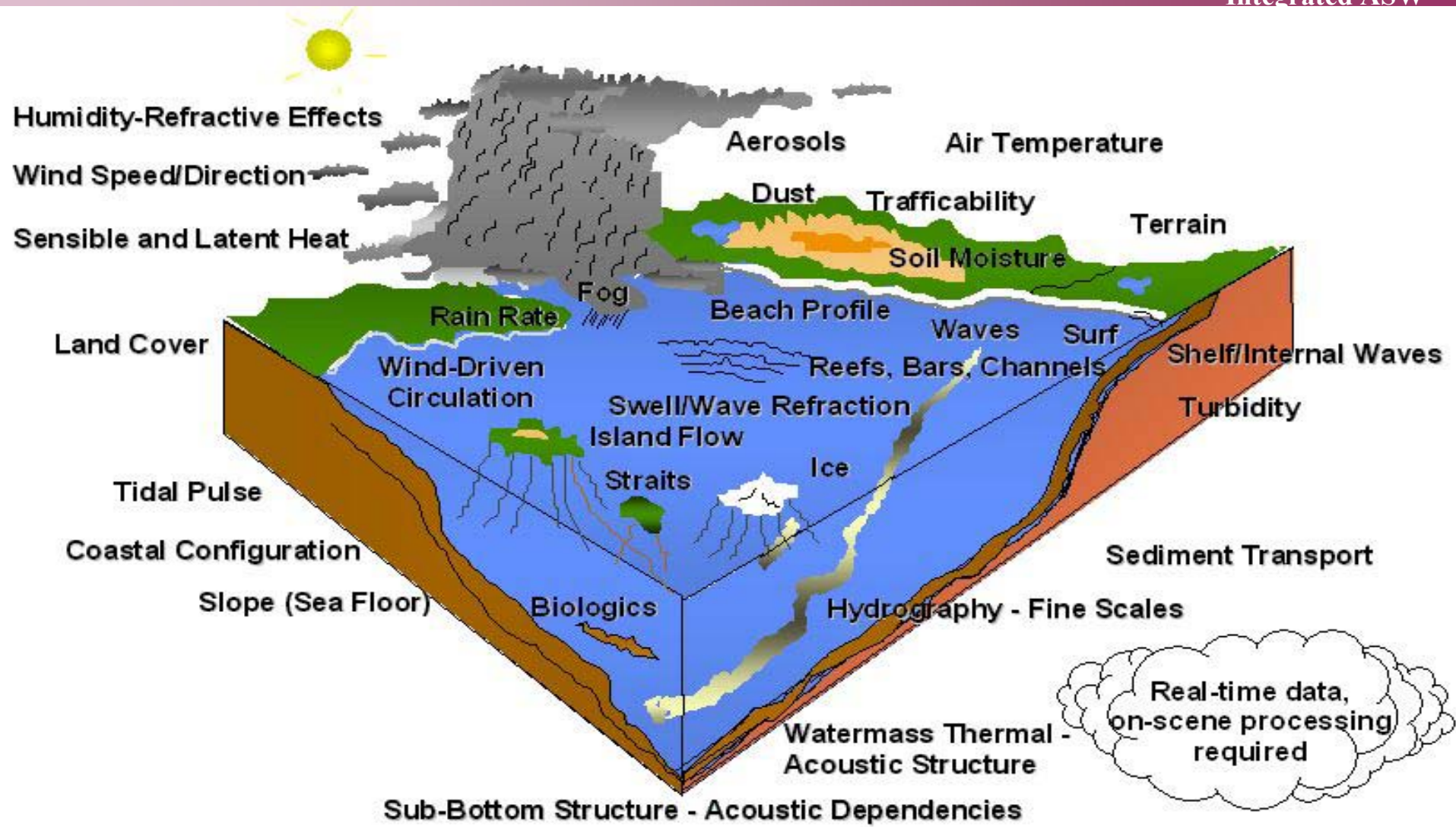
With apologies to CDR Gordon

State-of-the-Practice

Insufficient Detail and Inaccurate Inputs to Sensor Performance Prediction



Simplified State-of-the-World



What is missing?

- **Knowledge of the bottom**
  - Especially supporting target levels in sensor performance prediction
- **Adaptive METOC sampling strategies**
  - Effective use of assets to reduce uncertainty
- **Assimilation of bottom properties**
- **Sharing of METOC data**
  - Tactical Environmental Data Server (TEDS) development conference yielded a lack of a CONOPS to support tactical USW
  - Lack the “same” sensor performance predictions across platforms
- **Knowing what we do not know**

Technology Focus

- **In-Situ measurement of**
  - Acoustic Systems Sensor Performance Prediction
    - **Sound speed profile**
    - **Bottom properties**
    - **MODAS improvements for shallow water**
    - **Surface Ship, Submarine, Air IUSS**
  - Non-Acoustic Systems
    - **In-Situ through the sensor measurement**
    - **Inclusion of optical data in TEDS**
- **Sharing information between combatants or within battlegroup**
  - Limited bandwidth
  - Focus is on estimating sensor performance
- **Uncertainty - What is the impact and what do we do**