

Air and Space Natural Environment Modeling and Simulation Executive Agent



INTEGRATED NATURAL ENVIRONMENT AUTHORITATIVE REPRESENTATION PROCESS (INEARP)

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ESG Development Lead**

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Motivation



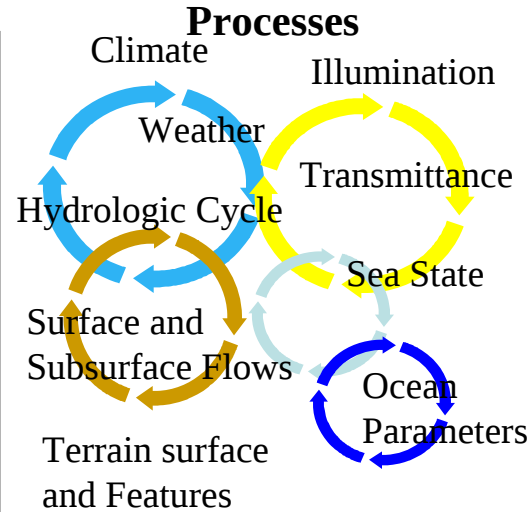
- In many cases, a simulation's fidelity depends on interaction with the environment
 - Aircraft tactics based on clouds and visibility
 - Naval tactics based on acoustic performance
 - Troop movement rate determined by ground wetness
- Environment must be realistic and consistent
 - Should see ground get wet if it rains
 - Should see ocean response to high winds



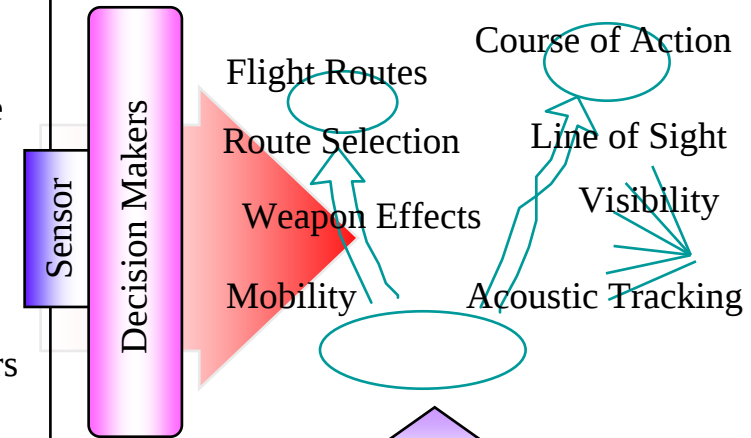


Integrated Natural Environment

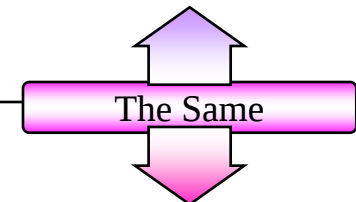
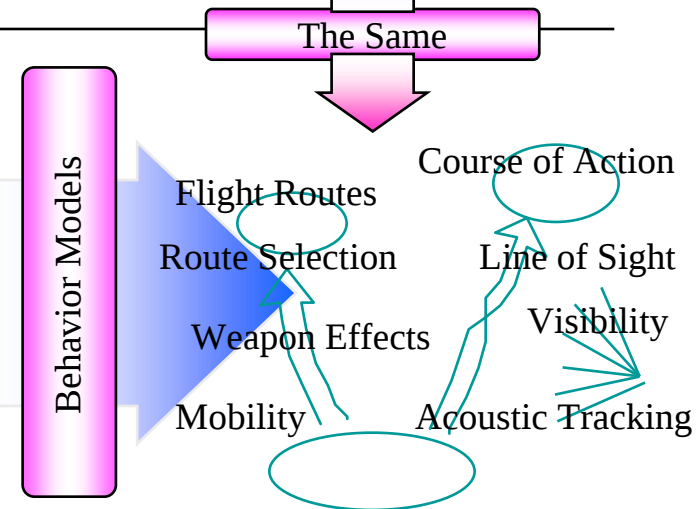
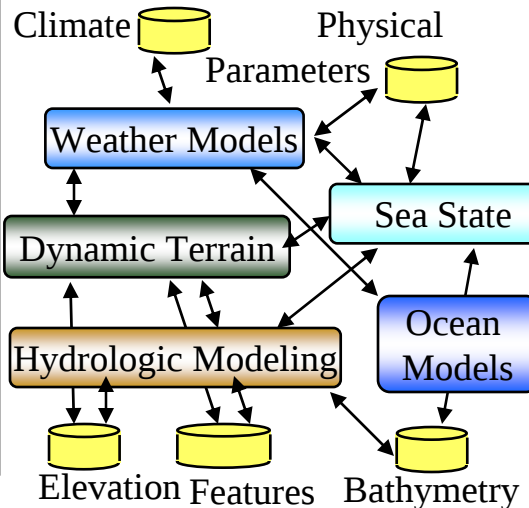
Natural



System Performance



Synthetic



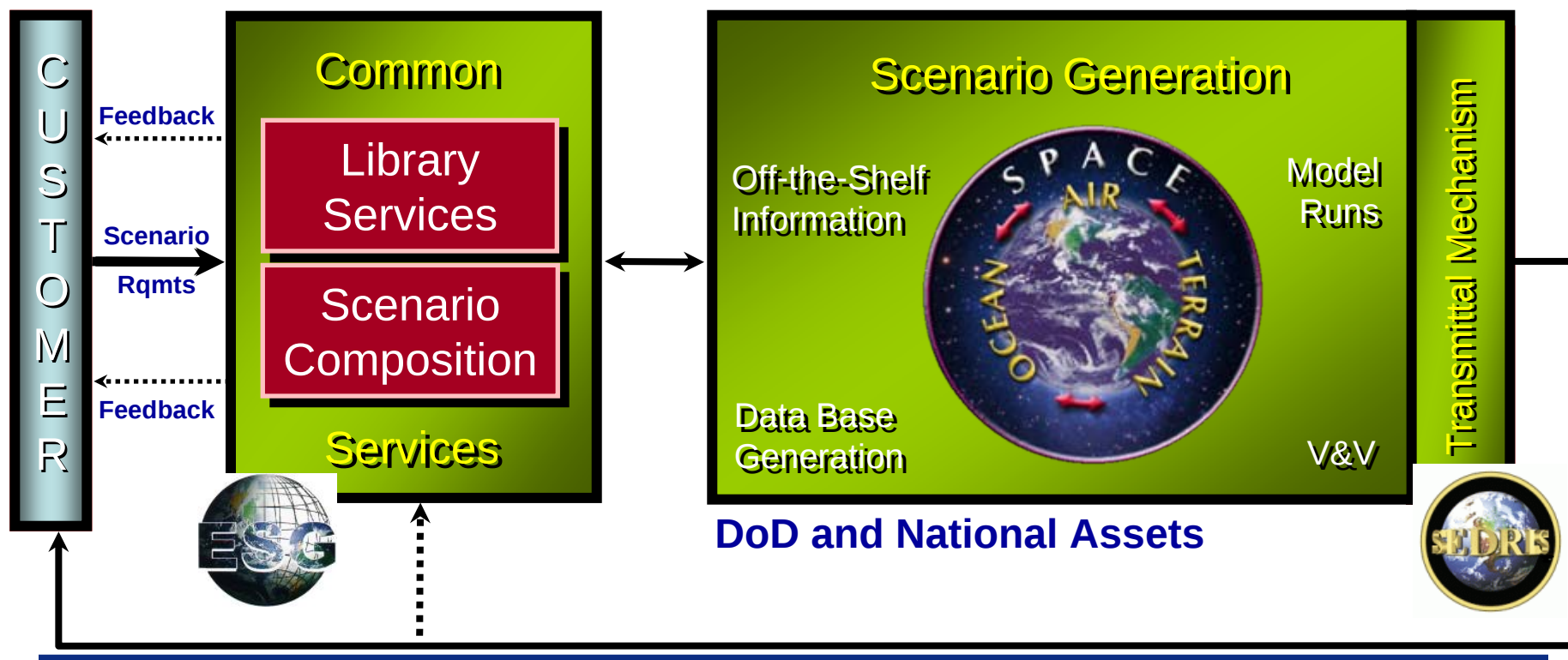


INEARP: A Strategy and Process Model for Environment Support M&S

Integrated Natural Environment Authoritative Representation Process (INEARP)

The Challenge

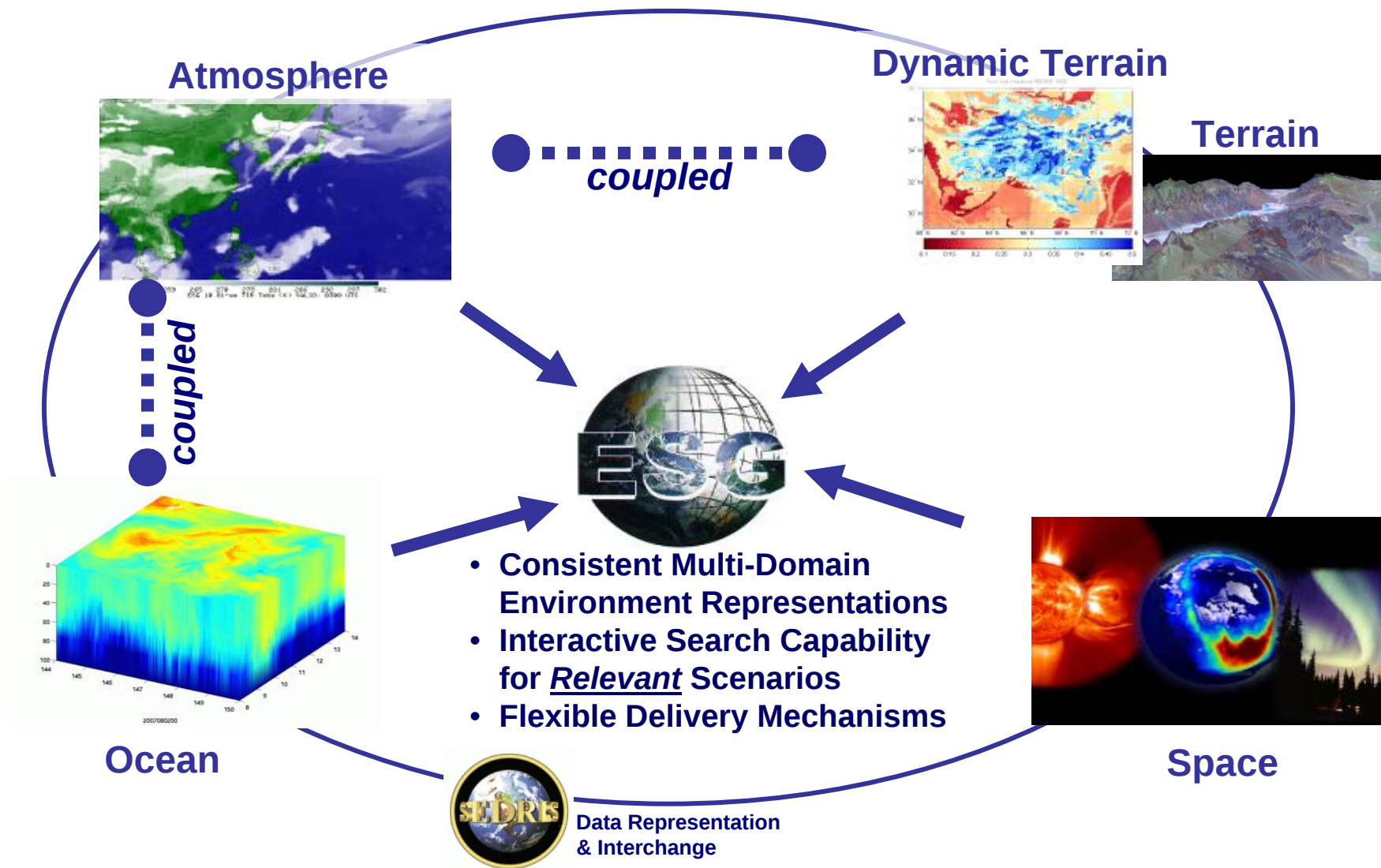
Create a physically consistent, cross-domain authoritative “ground truth” environment representation that meets user requirements.





Environmental Scenario Generator

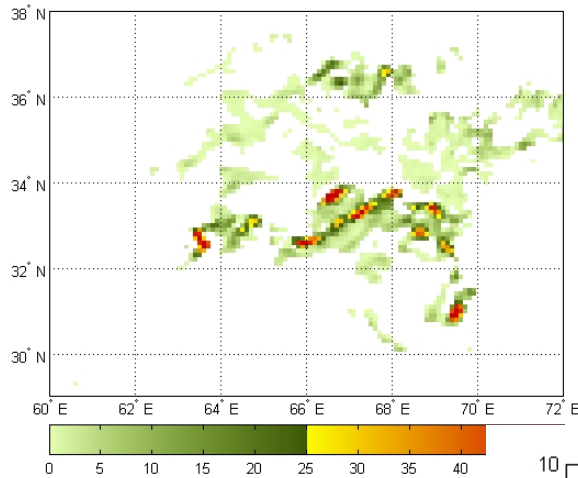
Key Enabling Technology for the INEARP



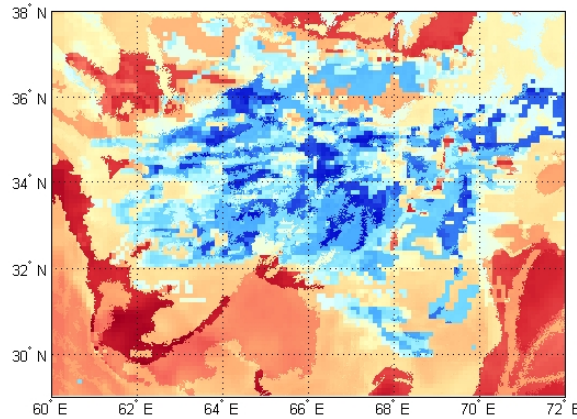


Atmosphere - Terrain Coupling

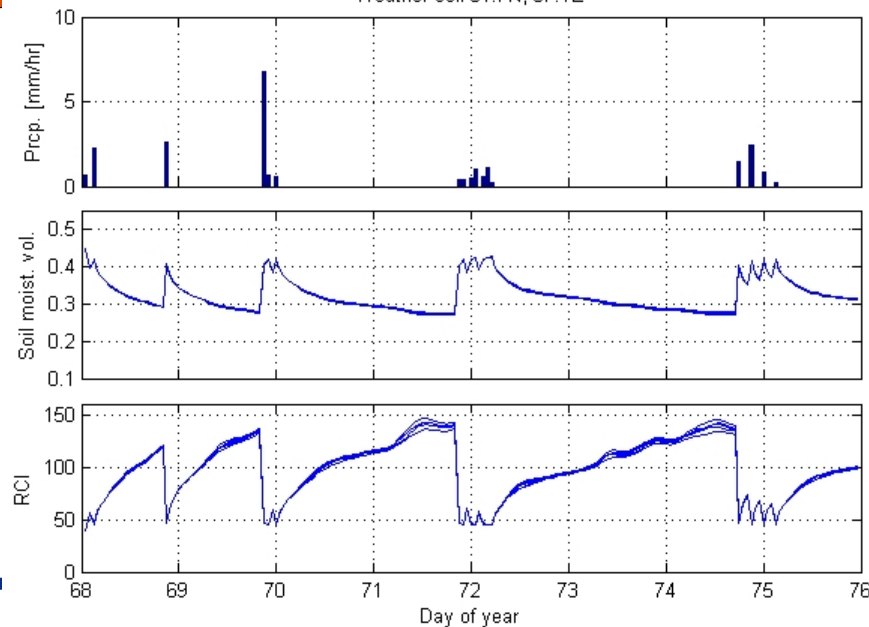
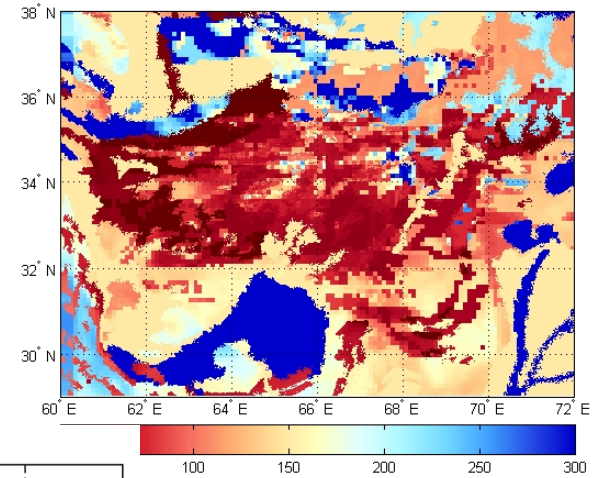
Precipitation Field

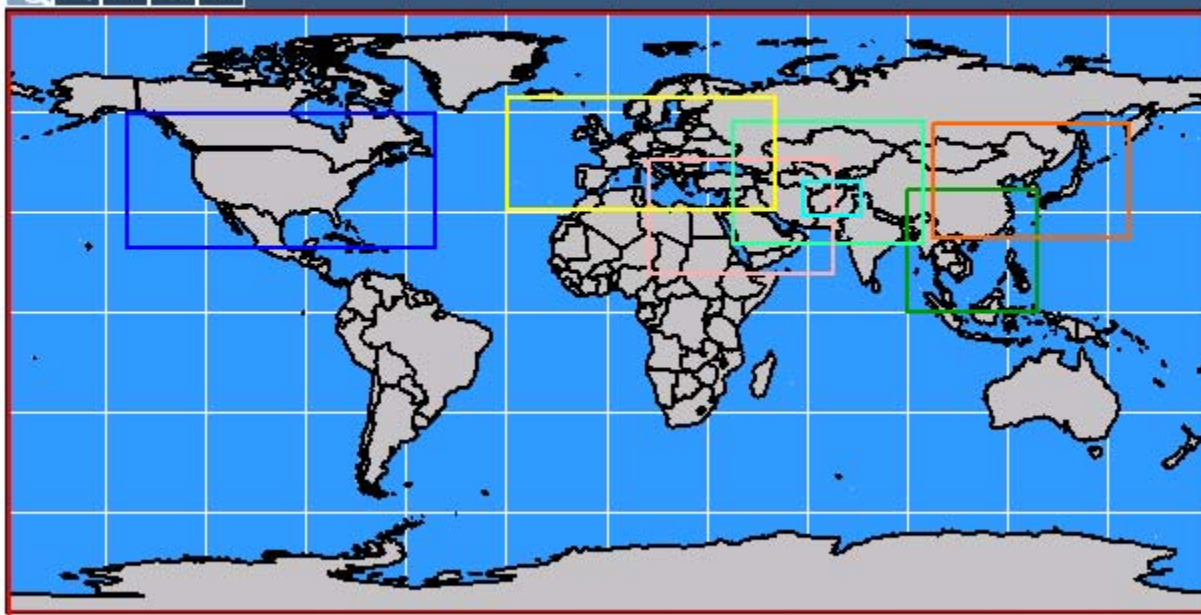


Dynamic Soil Moisture



Dynamic Soil Cone Index





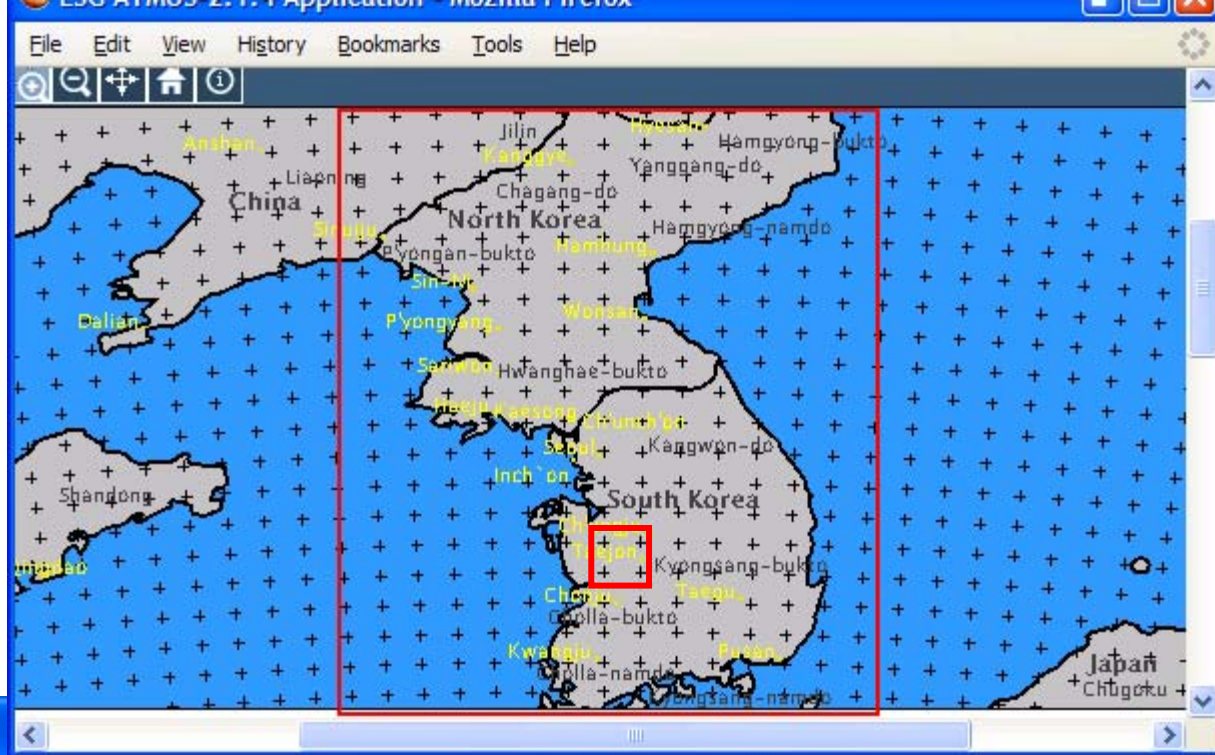
- ☒ WorldGrid
- ☒ Countries
- ☒ States/Provinces
- ☒ Cities
- ☒ Rivers
- ☒ Lakes

Atmosphere Resources

☐	■ NCEP/NCAR Reanalysis	✓	01/01/1950 - 06/30/2006	6 hours	2.5 deg
☐	■ ACMES CASIA	✓	10/01/1986 - 09/30/1996	1 hour	40 km
☐	■ ACMES IRAQ	✓	10/01/1986 - 09/30/1996	1 hour	40 km
☐	■ ACMES KOR4	✓	10/01/1986 - 09/30/1996	1 hour	40 km
☐	■ ACMES SEAS2	✓	10/01/1986 - 09/30/1996	1 hour	40 km
☐	■ ACMES EUROPE	✓	10/01/1986 - 09/30/1996	1 hour	40 km
☐	■ ACMES Conus3	✓	10/01/1986 - 09/30/1996	1 hour	40 km
☐	■ ACMES CASIAB	✓	10/01/1986 - 09/30/1996	1 hour	10 km

Space Resources

☐	■ Space Weather Global Derived Indices	✓	01/01/1991 - 12/31/2002	1 hour	0.0 deg
☐	■ Space Weather Global Observed Indices	✓	01/01/1991 - 12/31/2002	1 hour	0.0 deg

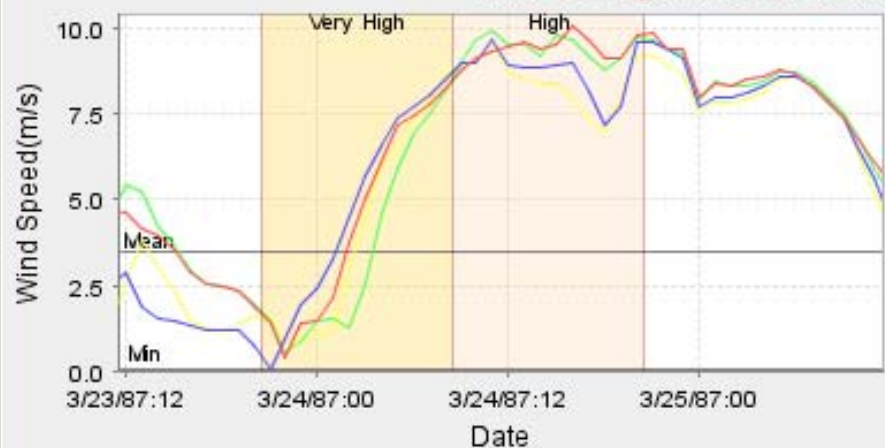


- Mozilla Firefox

s Tools Help

Add Segment				Delete Segment >				Delete Segment <			
Segment Duration: 12 Hour v				Segment Duration: 12 Hour v							
Criteria	Operator	T1	T2	Operator	T1	T2					
Temperature(F) @ Surface	Very High v	0.0	0.0	Low v	0.0	0.0	☐	☐			
Total Cloud Cover(%) @ Surface	Any Value v	0.0	0.0	Any Value v	0.0	0.0	☐	☐			
Wind Direction(degTrue) @ Surface	t1 < Parm < t2 v	180.0	270.0	t1 < Parm < t2 v	270.0	360.0	☐	☐			
Wind Speed(m/s) @ Surface	Very High v	0.0	0.0	High v	0.0	0.0	☐	☐			

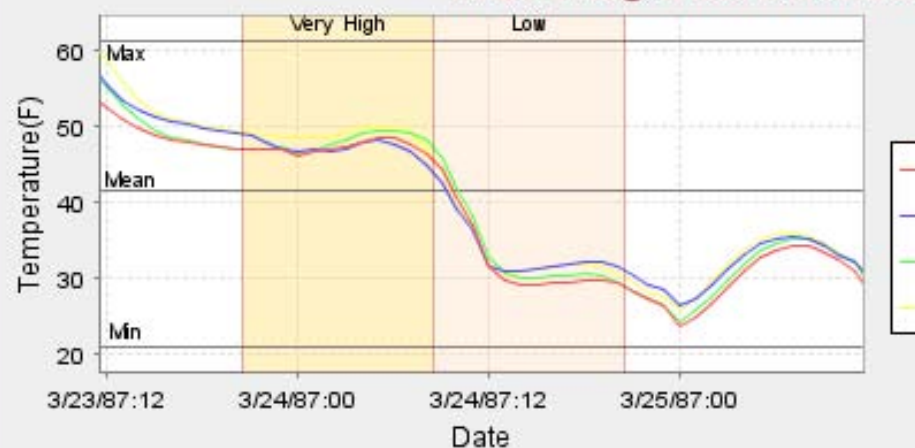
Wind Speed@Surface of Ground



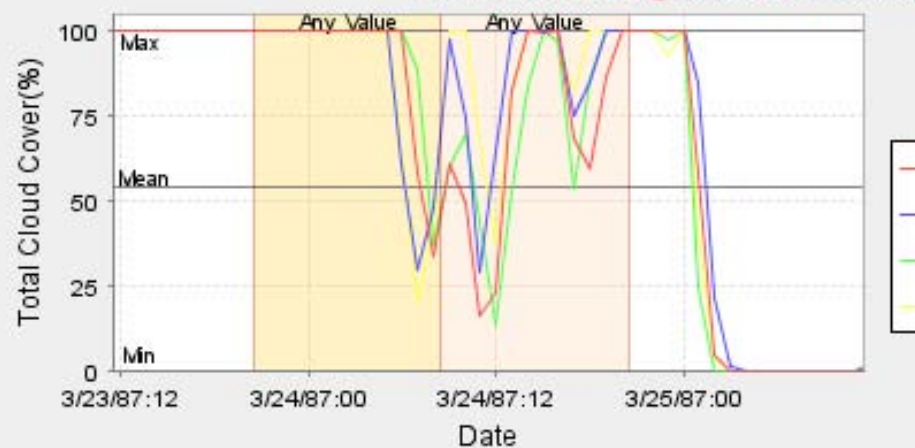
Wind Direction@Surface of Ground



Temperature@Surface of Ground/S

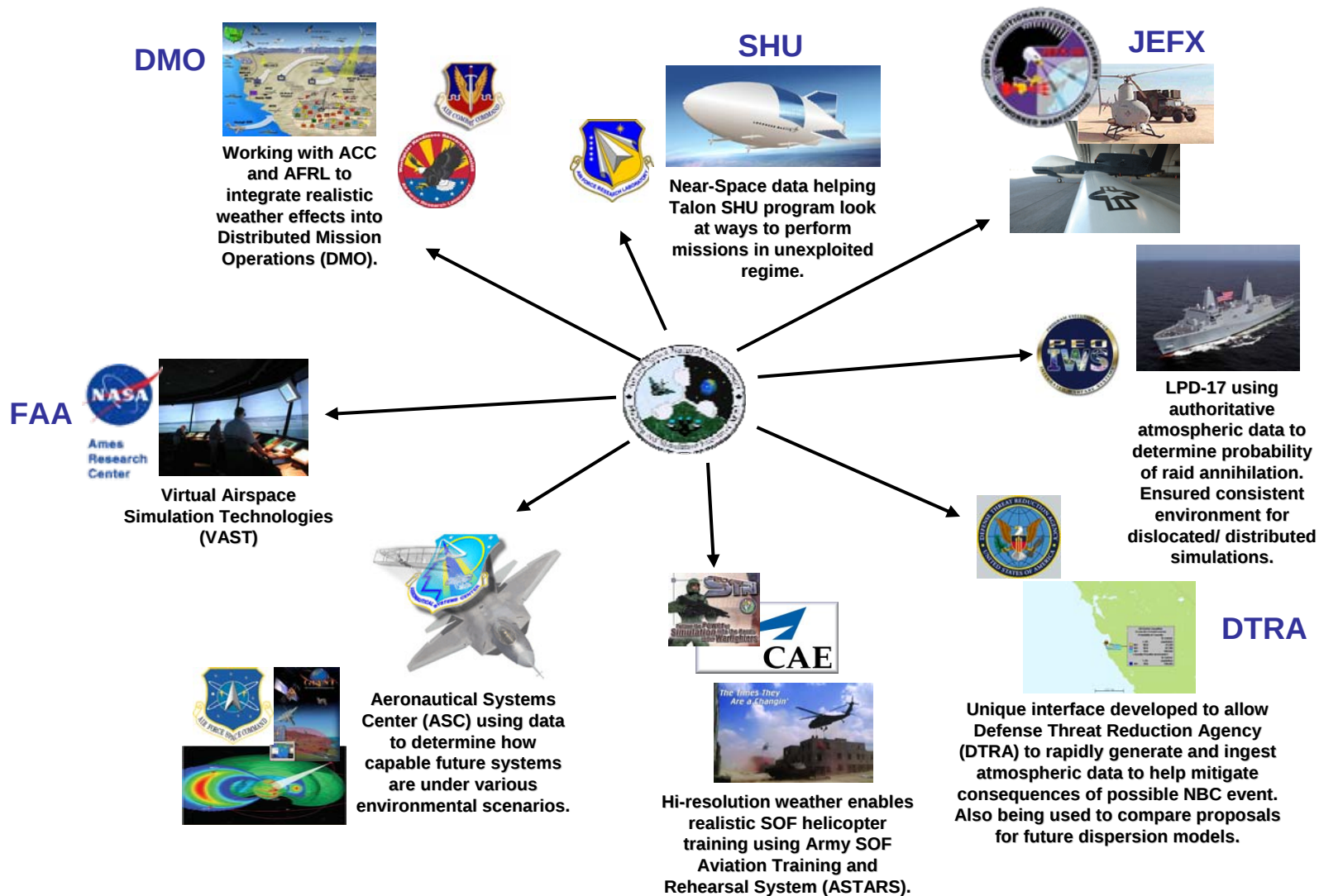


Total Cloud Cover@Surface of Ground





Programs Leveraging the INEARP

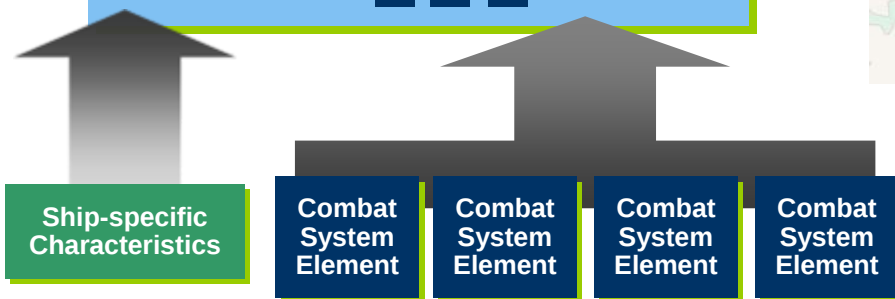
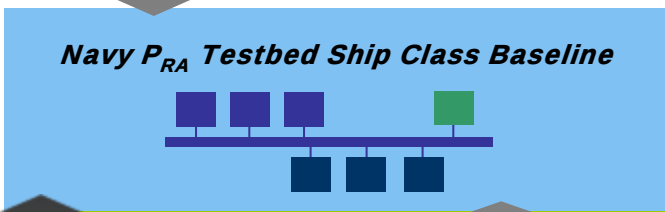




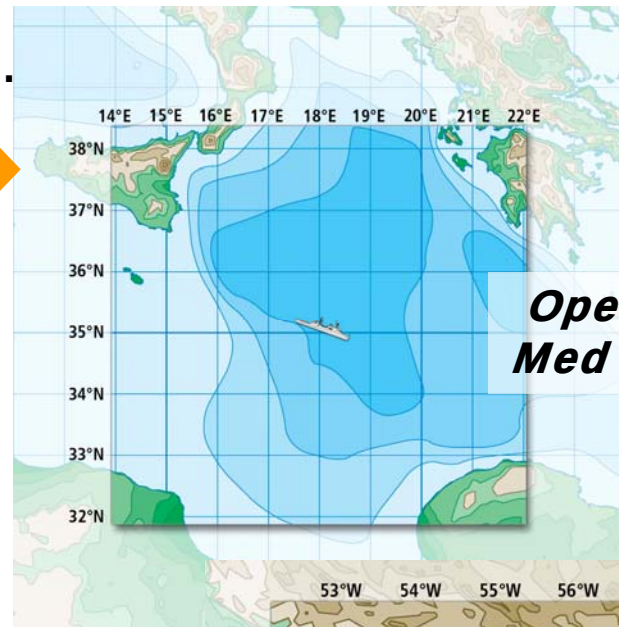
PEO/IWS Enterprise P_{RA} Testbed

“Virtual Range”

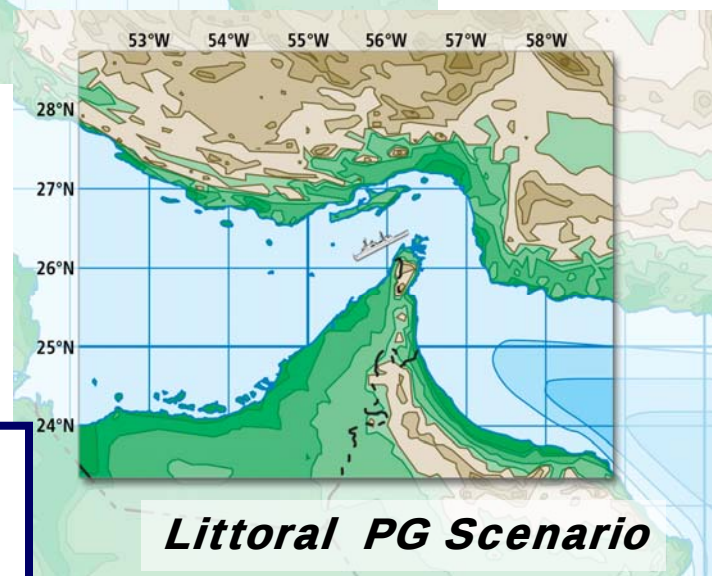
Obtained from ESG ..



“Virtual Test Ship”



**Open Ocean
Med Scenario**



Littoral PG Scenario

RDML Frick: “Thanks to ESG technology... for datasets to meet specified conditions...(program) lifetime cost avoidance \$50M!”



INEARP Program

- **Three-Year effort (FY-08 is year two) sponsored by the Acquisition community via the M&S Coordination Office**
 - **Sponsor: Mr. Dipetto**
 - **Oversight: Mr. Lewis, DoD ASNE MSEA**
 - **Performance: AER, Inc.**

- **FY-08 Funded Development Initiatives**
 - **Working with NGDC on remote access to Space resources**
 - **Integration of higher-res atmospheric data archives (ERA-40) and modeling capabilities (WRF)**
 - **Standup of SIPRNET site**
 - **Upgrade of SEDRIS capabilities per FCS requirements**
 - **Expanded Web Service capabilities**

JOINT END-TO-END PROGRAM

“A Factory to Foxhole Process”

#1

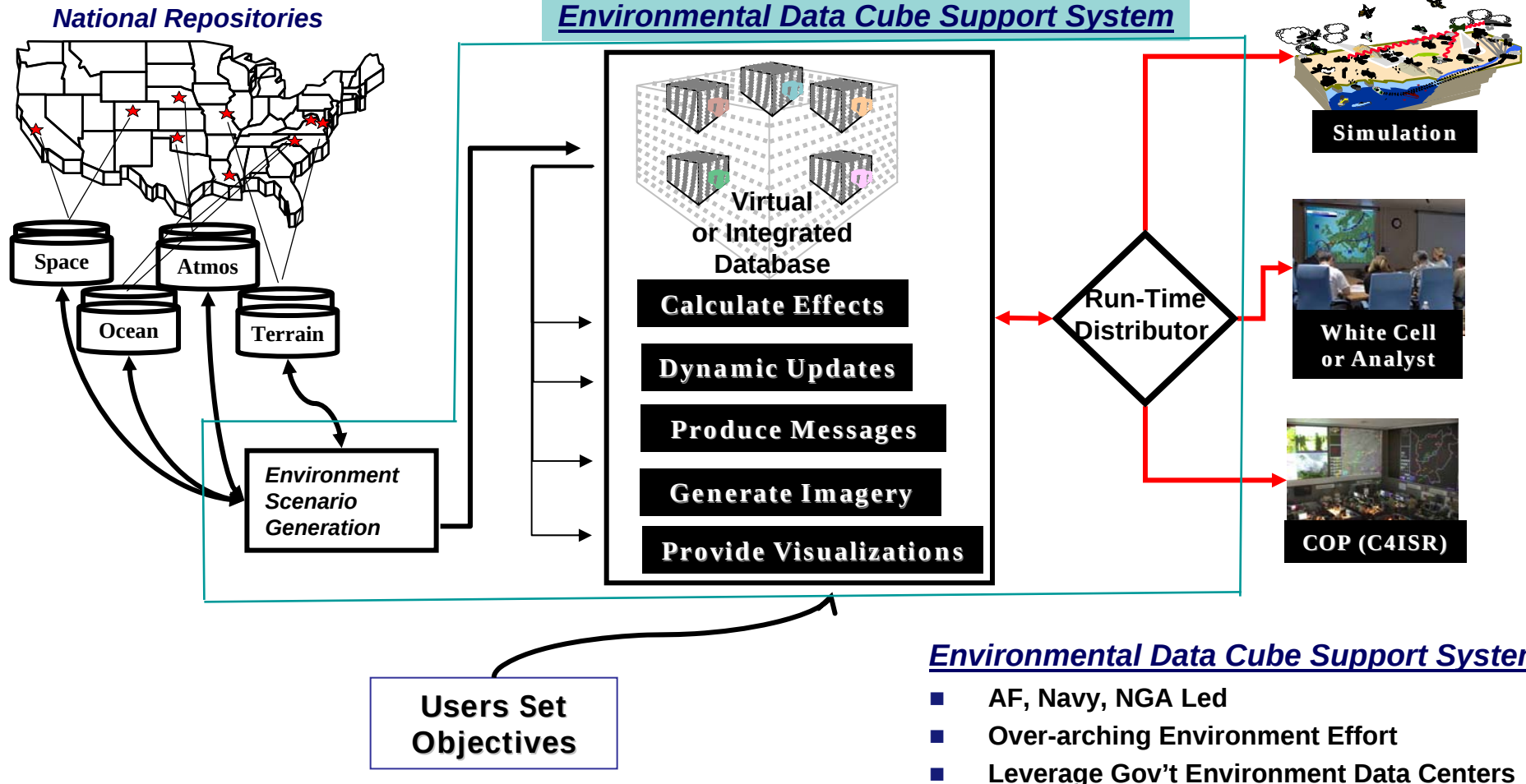
**Build & Tailor
Data**

#2

**Correlate
Products, Effects**

#3

**Distribute
Live, Virtual, Constructive**





Summary

- Realistic M&S requires high-fidelity, consistent, and relevant multi-domain environment representations
- The INEARP provides the roadmap. The ESG and SEDRIS are two key enabling technologies
 - National data and modeling assets provide the content
- The ASNE MSEA is working with the Ocean and Terrain MSEA's to realize the full INEARP vision



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