



Dynamic Data Driven Application Systems (DDDAS)

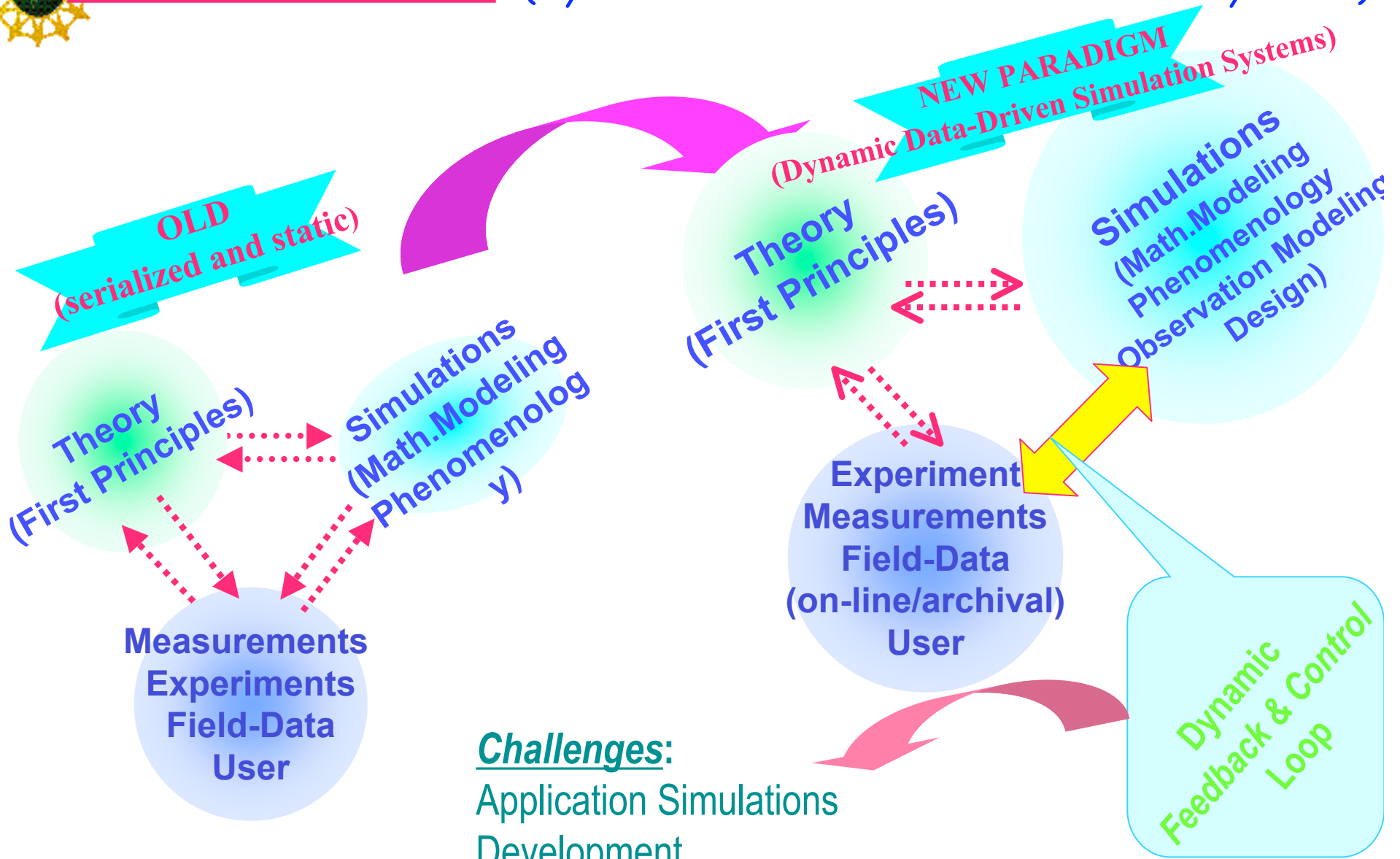
**New Direction for
applications/simulations
and
measurement methodology**

**Multi-agency DDDAS program - NSF, NIH, NOAA
with cooperation with the EU/IST & e-Sciences Programs
(www.cise.nsf.gov/dddas)**

**Dr. Frederica Darema
Senior Science and Technology Advisor
NSF**



What is DDDAS *(Symbiotic Measurement & Simulation Systems)*



- Challenges:**
- Application Simulations
 - Development
 - Algorithms
 - Measurement Instruments Interfaces



DDDAS FY05 Competition Proposals awarded (cont'd)

- Farhat - A Dynamic Data Driven System for Structural Health Monitoring and Critical Event Prediction
- Ding - A Framework For the Dynamic Data-Driven Fault Diagnosis of Wind Turbine Systems
- Laidlaw - Interactive Data-driven Flow-simulation Parameter Refinement for Understanding the Evolution of Bat Flight
- Rawlings - Measuring and Controlling Turbulence and Particle Populations
- Knight - SEP: Application of DDDAS to Assessment of Thermal Systems Using Combined Experiment and Simulation

- Barabasi- Integrated Wireless Phone Based Emergency Response System (WIPER)
- Fujimoto - Dynamic, Simulation-Based Management of Surface Transportation Systems
- Mahinthakumar - An adaptive cyberinfrastructure for threat management in urban water distribution systems

+...



DDDAS FY05 Competition Proposals awarded (cont'd)

- Ghattas - MIPS: A Real-Time Measurement-Inversion-Prediction-Steering Framework for Hazardous Events
- How - Coordinated Control of Multiple Mobile Observing Platforms for Weather Forecast Improvement
- Bernstein - Targeted Data Assimilation for Disturbance-Driven Systems: Space weather Forecasting
- McLaughlin: - Data Assimilation by Field Alignment
- Leiserson - Planet-in-a-Bottle: A Numerical Fluid-Laboratory
- Chrysostomidis - Multiscale Data-Driven POD-Based Prediction of the Ocean
- Ntaimo - Dynamic Data Driven Integrated Simulation and Stochastic Optimization for Wildland Fire Containment
- Allen - DynaCode: A General DDDAS Framework with Coast and Environment Modeling Applications
- Douglas - Adaptive Data-Driven Sensor Configuration, Modeling, and Deployment for Oil, Chemical, and Biological Contamination near Coastal Facilities



DDDAS FY05 Competition Proposals awarded (cont'd)

- Clark - Dynamic Sensor Networks - Enabling the Measurement, Modeling, and Prediction of Biophysical Change in a Landscape
- Golubchik - A Generic Multi-scale Modeling Framework for Reactive Observing Systems
- Williams - Real-Time Astronomy with a Rapid-Response Telescope Grid
- Gilbert - Optimizing Signal and Image Processing in a Dynamic, Data-Driven Application System
- Liang - SEP: Intergrating Multipath Measurements with Site Specific RF Propagation Simulations
- Chen - SEP: Optimal interlaced distributed control and distributed measurement with networked mobile actuators and sensors

+...



DDDAS FY05 Competition

Proposals awarded

- Oden - Dynamic Data-Driven System for Laser Treatment of Cancer
- Rabitz - Development of a closed-loop identification machine for bionetworks (CLIMB) and its application to nucleotide metabolism
- Fortes - Dynamic Data-Driven Brain-Machine Interfaces
- McCalley - Auto-Steered Information-Decision Processes for Electric System Asset Management
- Downar - Autonomic Interconnected Systems: The National Energy Infrastructure
- Sauer- Data-Driven Power System Operations
- Ball - Dynamic Real-Time Order Promising and Fulfillment for Global Make-to-Order Supply Chains
- Thiele - Robustness and Performance in Data-Driven Revenue Management
- Son - Dynamically-Integrated Production Planning and Operational Control for the Distributed Enterprise



Tally of FY05 Awarded Projects

- 248 proposals received (June 13); total requested amount \$175M
- 32 projects 48 (proposals) awarded; total amount of funding \$16M (US)
- average number of reviews per proposal = ~7 + the panel summary
- Rating profile:
 - 22 in HR category
 - 8 in R category (6 were funded as “seeding” efforts; 2/SMRPs-small\$s)
 - 2 in LR (funded as seeding efforts)
- Project size profile :
 - 11-collaborative; 21-single proposals
 - 15 TMRP
 - 13 SMRP
 - 4 SEP
 - of these 7 were funded as “seeding efforts (\$30K-\$220K), 6 TMRPs and 1SMRP



DDDAS Projects that have been funded/spawned through ITR, NGS & Sensors PRGMS

"~DDDAS" proposals awarded in FY00
ITR Competition

- Pingali, Adaptive Software for Field-Driven Simulations



"~DDDAS" proposals awarded in FY01 ITR Competition

- Biegler - Real-Time Optimization for Data Assimilation and Control of Large Scale Dynamic Simulations
- Car - Novel Scalable Simulation Techniques for Chemistry, Materials Science and Biology
- Knight - Data Driven design Optimization in Engineering Using Concurrent Integrated Experiment and Simulation
- Lonsdale - The Low Frequency Array (LOFAR) - A Digital Radio Telescope
- McLaughlin - An Ensemble Approach for Data Assimilation in the Earth Sciences
- Patrikalakis - Poseidon - Rapid Real-Time Interdisciplinary Ocean Forecasting: Adaptive Sampling and Adaptive Modeling in a Distributed Environment
- Pierrehumbert- Flexible Environments for Grand-Challenge Climate Simulation
- Wheeler- Data Intense Challenge: The Instrumented Oil Field of the Future



"~DDDAS" proposals awarded in FY02 ITR Competition

- Carmichael - Development of a general Computational Framework for the Optimal Integration of Atmospheric Chemical Transport Models and Measurements Using Adjoints
- Douglas-Ewing-Johnson - Predictive Contaminant Tracking Using Dynamic Data Driven Application Simulation (DDDAS) Techniques
- Evans - A Framework for Environment-Aware Massively Distributed Computing
- Farhat - A Data Driven Environment for Multi-physics Applications
- Guibas - Representations and Algorithms for Deformable Objects
- Karniadakis - Generalized Polynomial Chaos: Parallel Algorithms for Modeling and Propagating Uncertainty in Physical and Biological Systems
- Oden - Computational Infrastructure for Reliable Computer Simulations
- Trafalis - A Real Time Mining of Integrated Weather Data



"~DDDAS" proposals awarded in FY03 ITR Competition

- Baden - Asynchronous Execution for Scalable Simulation in Cell Physiology
- Chaturvedi- Synthetic Environment for Continuous Experimentation (Crisis Management Applications)
- Droegemeier-Linked Environments for Atmospheric Discovery (LEAD)
- Kumar - Data Mining and Exploration Middleware for Grid and Distributed Computing
- Machiraju - A Framework for Discovery, Exploration and Analysis of Evolutionary Data (DEAS)
- Mandel - DDDAS: Data Dynamic Simulation for Disaster Management (Fire Propagation)
- Metaxas- Stochastic Multicue Tracking of Objects with Many Degrees of Freedom
- Sameh - Building Structural Integrity
- {Sensors Program: Seltzer - Hourglass: An Infrastructure for Sensor Networks}



"~DDDAS" proposals awarded in FY04 ITR Competition

- Brogan - Simulation Transformation for Dynamic, Data-Driven Application Systems (DDDAS)
- Baldrige - A Novel Grid Architecture Integrating Real-Time Data and Intervention During Image Guided Therapy
- Floudas-In Silico De Novo Protein Design: A Dynamically Data Driven, (DDDAS), Computational and Experimental Framework
- Grimshaw: Dependable Grids
- Laidlaw: Computational simulation, modeling, and visualization for understanding unsteady bioflows
- Metaxas - DDDAS - Advances in recognition and interpretation of human motion: An Integrated Approach to ASL Recognition
- Wheeler: Data Driven Simulation of the Subsurface: Optimization and Uncertainty Estimation