Optimal Allocation of Parallel Computers for Operational Weather Prediction

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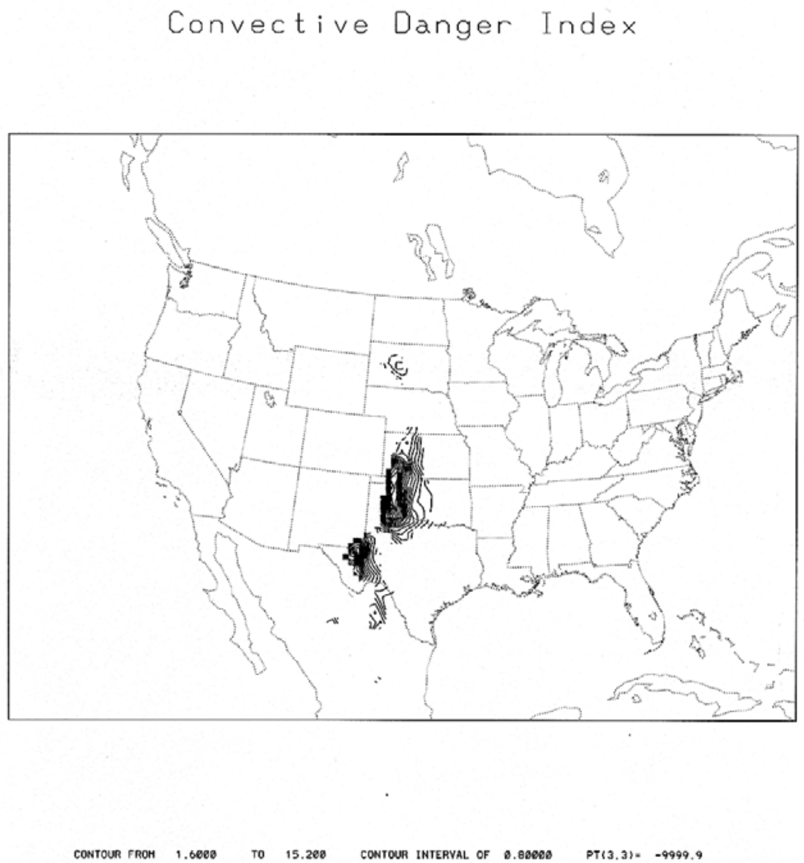
A presentation to:

11th Workshop on Use of HPC in Meteorology

25-29 October 2004



Convective Danger Index, May 3, 1999

BONUS: NOAA R&D PLANS

Optimal Allocation of Parallel Computers for Operational Weather Prediction

Idea: Can a modeling system automatically choose sub-domains for more detailed assimilation and model computations based on threat to life and property?

Approach: Use a statistical prediction system to predict weather that threatens life and property, and use that to determine the sub-domain for nesting to higher resolution.

Assumption: High resolution nesting and multiple ensemble runs allow better prediction for a limited domain under threat.

Test Case

- Use May 3, 1999 as test case (Oklahoma tornado case)

- Use Rapid Update Cycle model

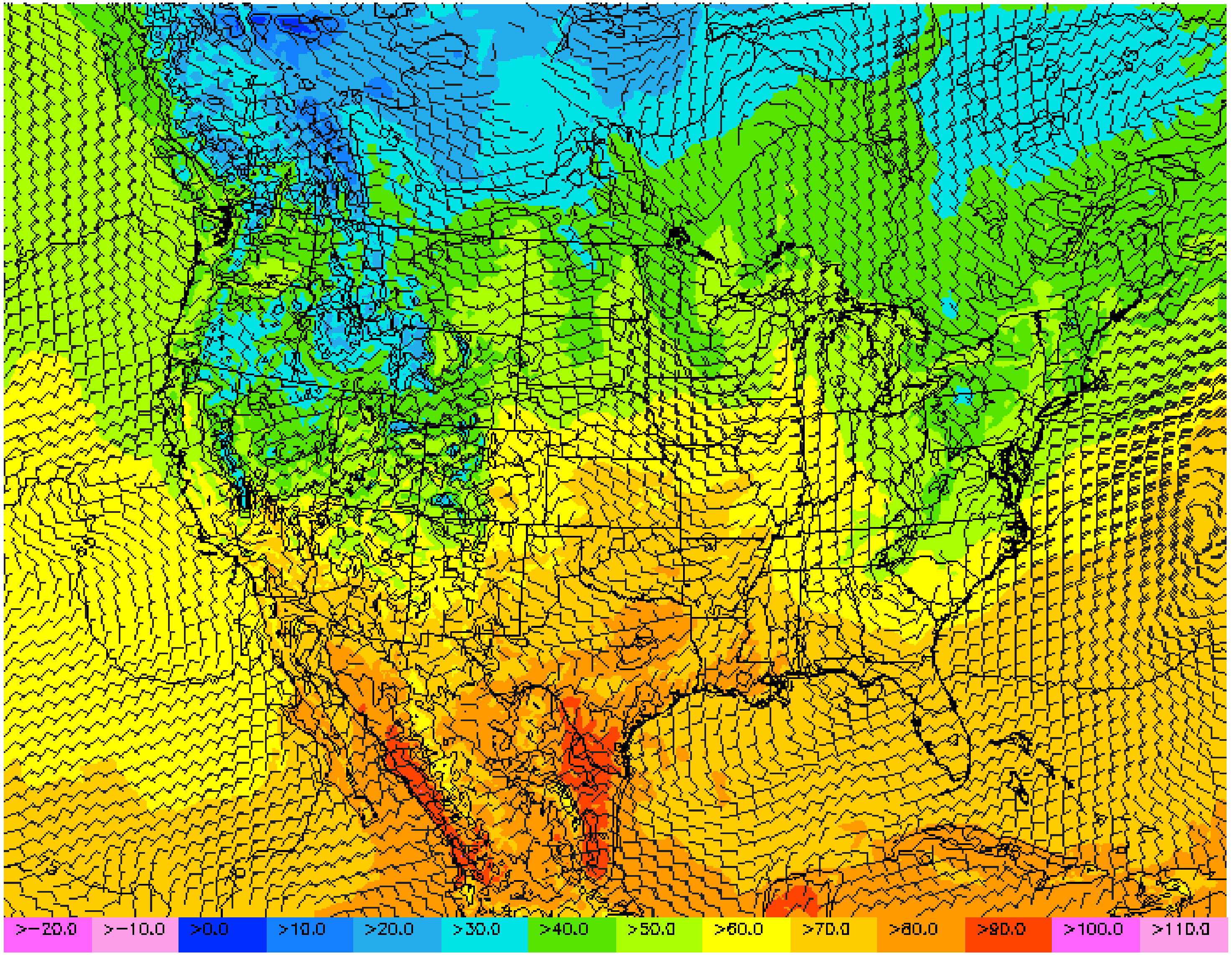
- Develop simple combination of:
  - Convective Available Potential Energy
  - Helicity
  - Population density

NOAA

Backup

RUC20

FSL

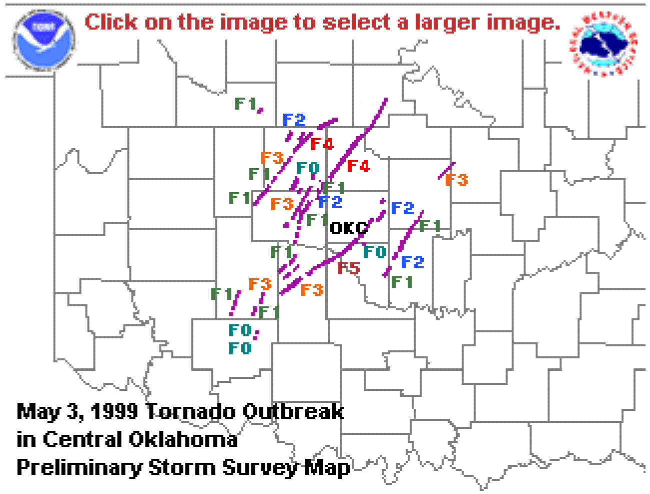


Surface Temperature / Winds (°F / Knots)

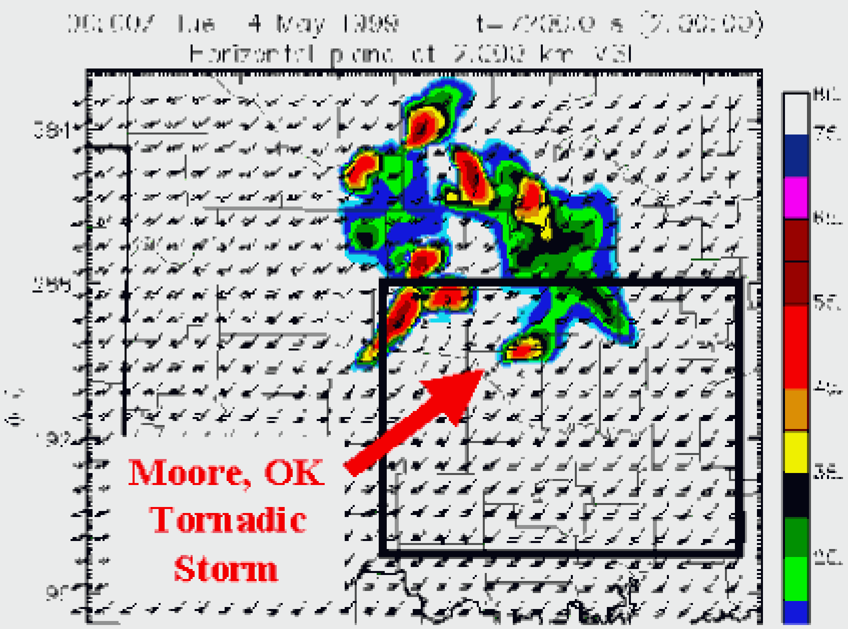
9-hr fcst valid 23-Oct-04 21:00Z

On May 3, 1999, Oklahoma and Kansas experienced a family tornado outbreak that killed 45 people and destroyed almost 3000 homes and businesses.

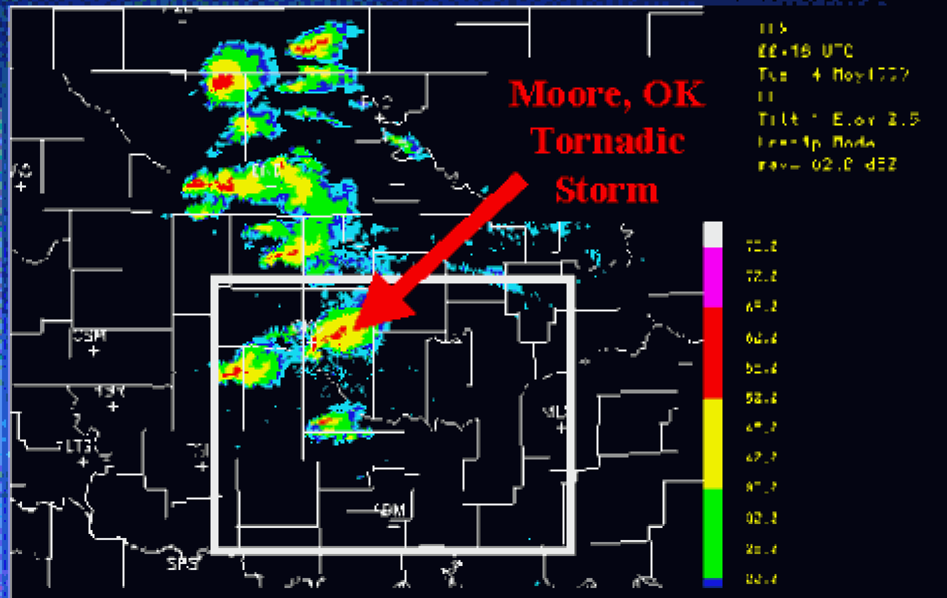
Mesoscale models run at 1 km resolution do a credible job of very short range supercell track prediction.



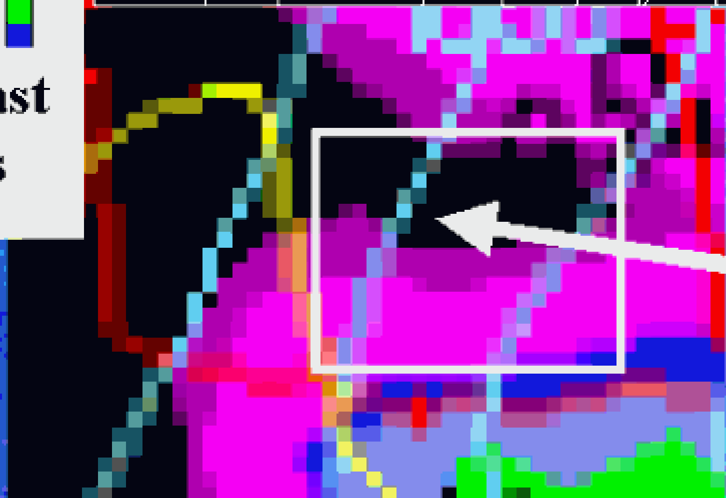
Comparison With Current Operational Model



2-Hour CAPS Computer Forecast Down to the Scale of Counties

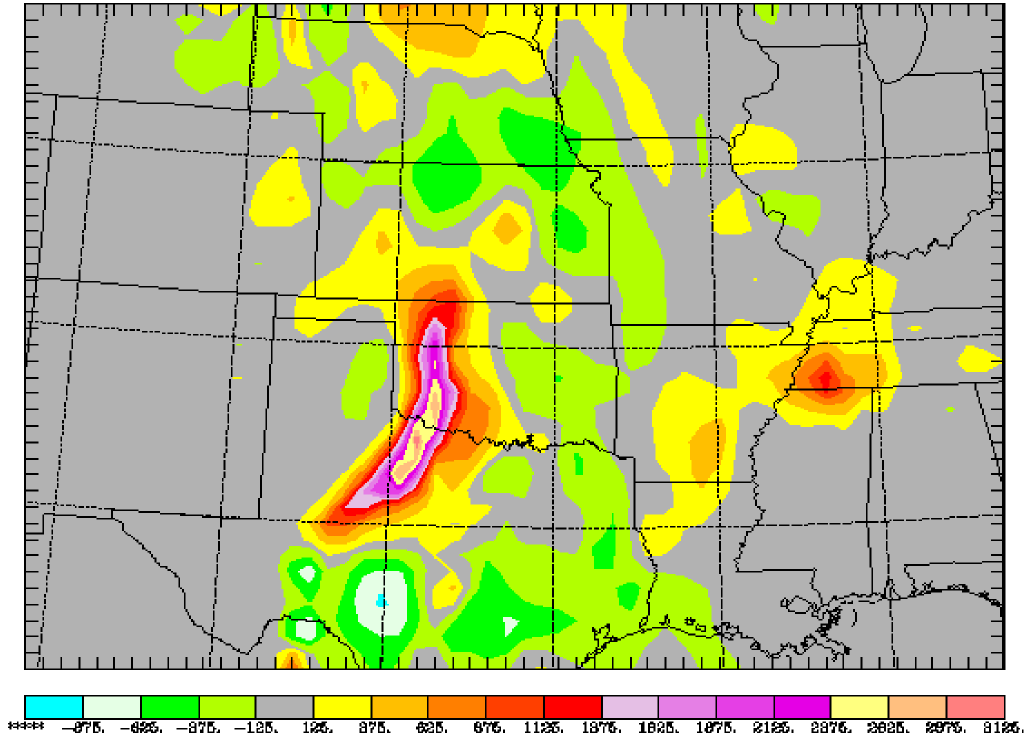


NEXRAD Radar Observations

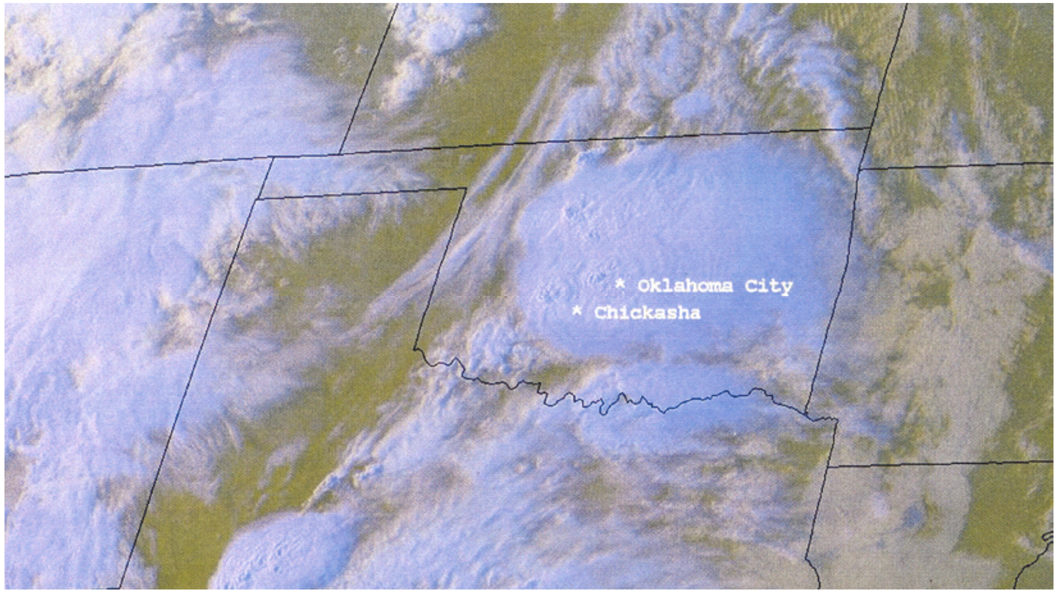


12-hour NWS Forecast (unable to represent individual thunderstorms)

The Convective Available Potential Energy was about 12,000 joules.



Satellite image taken at 0045 UT, during tornado outbreak.



General Form of the Convective Danger Index Equation

Convective Danger Index = c1* PD*(c2* CAPE + c3 * H)

where

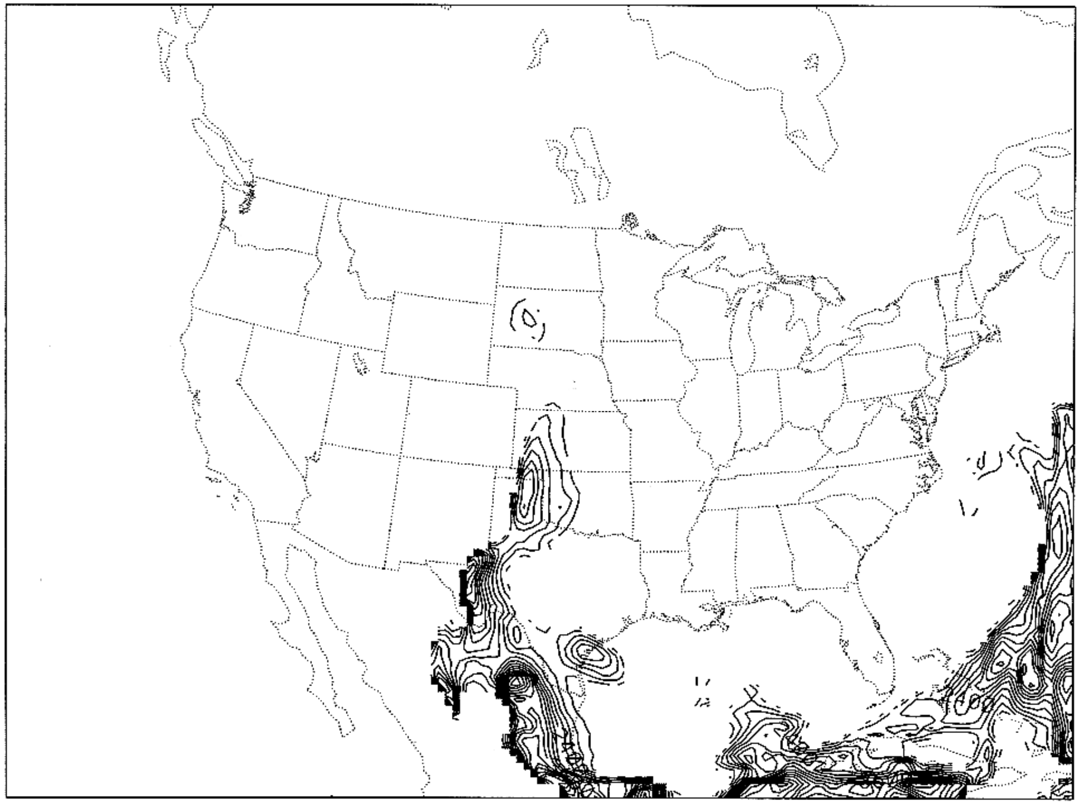
PD = Population Density

CAPE = Convective Available Potential Energy

H = Helicity

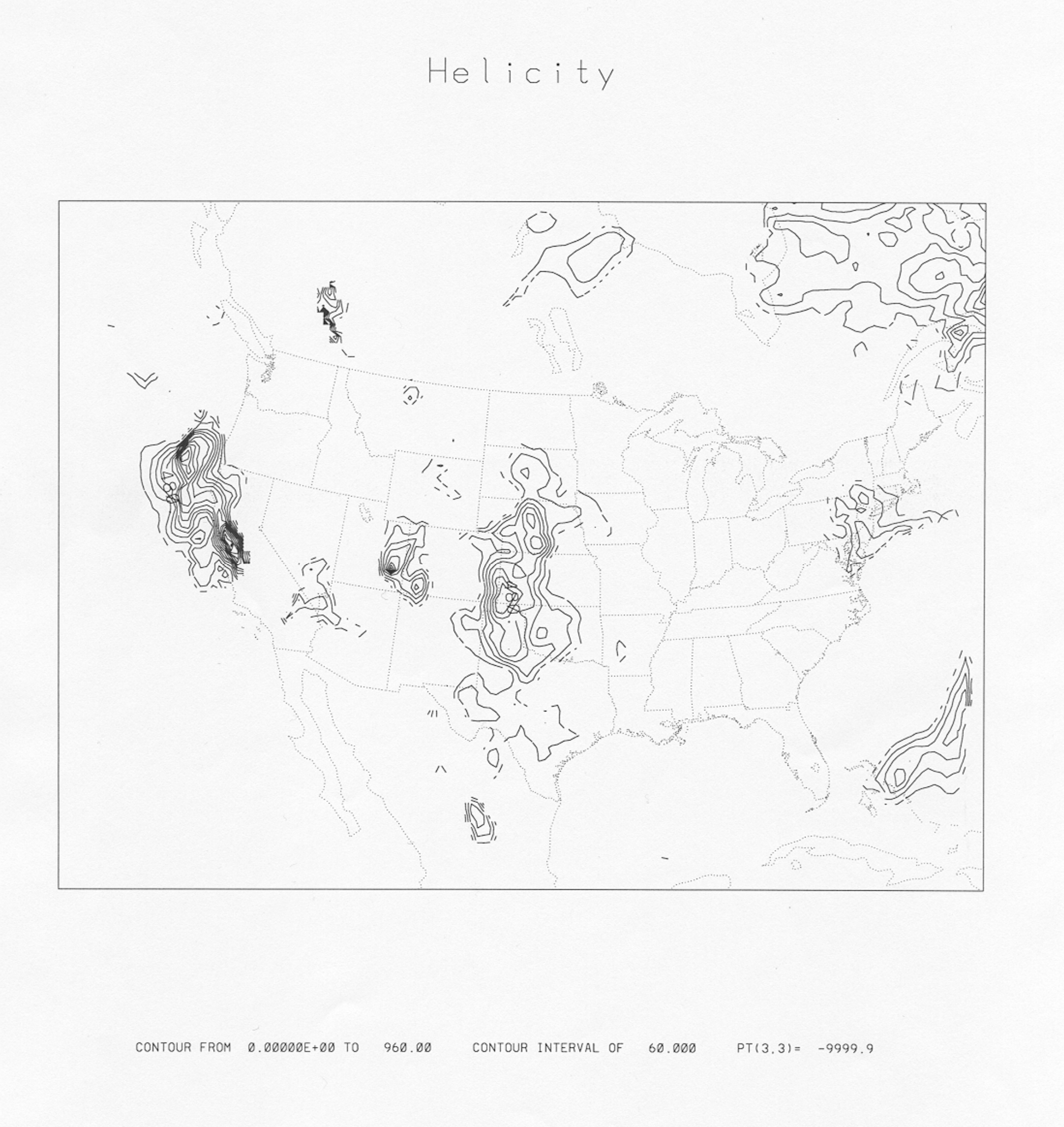
and c1,c2,and c3 are constants

CAPE



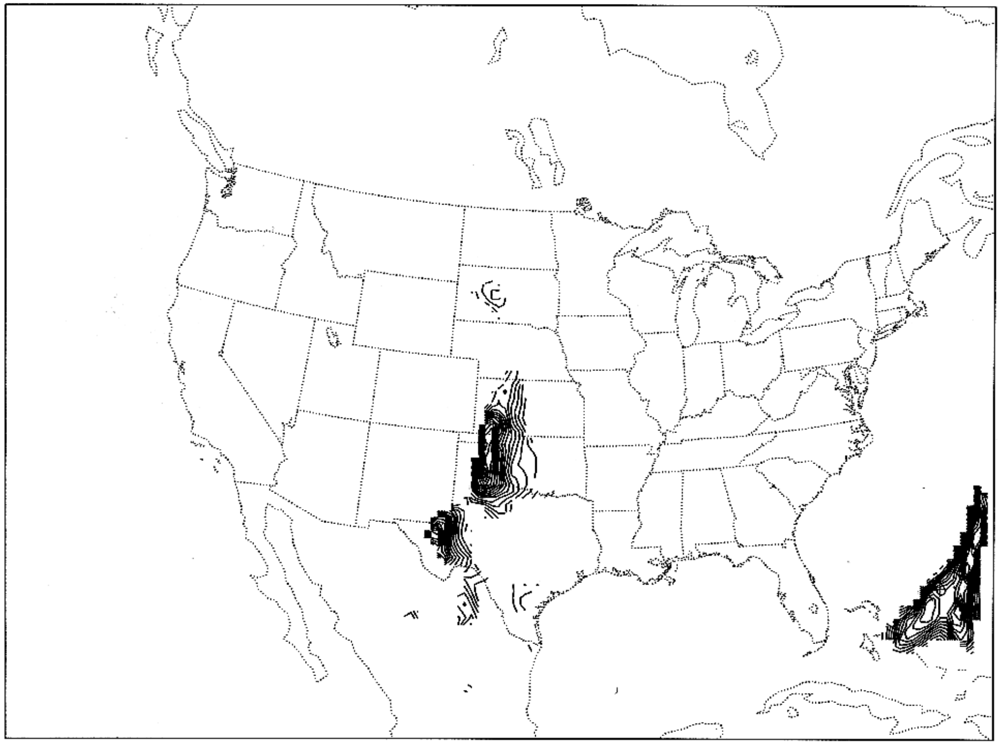
CONTOUR FROM 0.00000E+00 TO 5700.0 CONTOUR INTERVAL OF 300.00 PT(3,3)= -9999.9

Convective Available Potential Energy (CAPE) on May 3, 1999



Predicted helicity, May 3, 1999

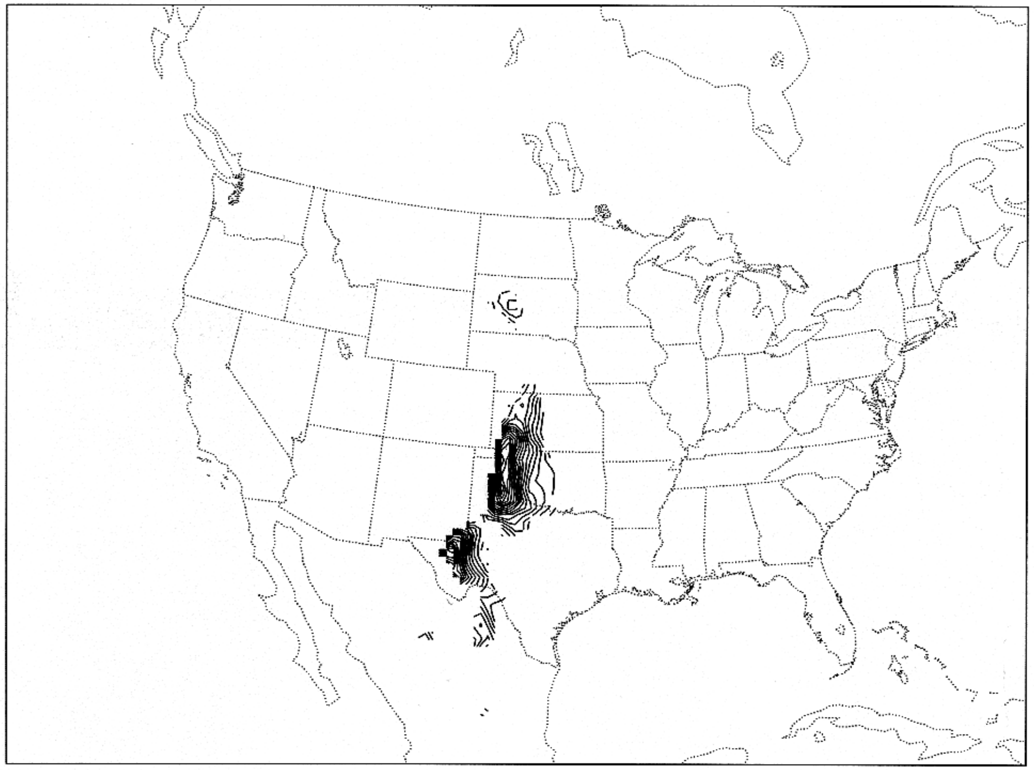
Convective Danger Index (no people)



CONTOUR FROM 1.6000 TO 15.200 CONTOUR INTERVAL OF 0.80000 PT(3,3)= -9999.9

Convective Danger Index without population variable.

Convective Danger Index



CONTOUR FROM 1.6000 TO 15.200 CONTOUR INTERVAL OF 0.80000 PT(3,3)= -9999.9

Convective Danger Index for May 3, 1999. Danger corresponds to the threat to life and property.

Conclusions

- Automatic determination of threat areas is feasible.

- The threat can include other factors (such as population and economic threat) than the meteorology.

- For parallel supercomputers and grid supercomputing, automatic allocation of computing resources (e.g. nesting and ensembles) will increase in importance.

A short presentation of a new approach to NOAA's High Performance Computing

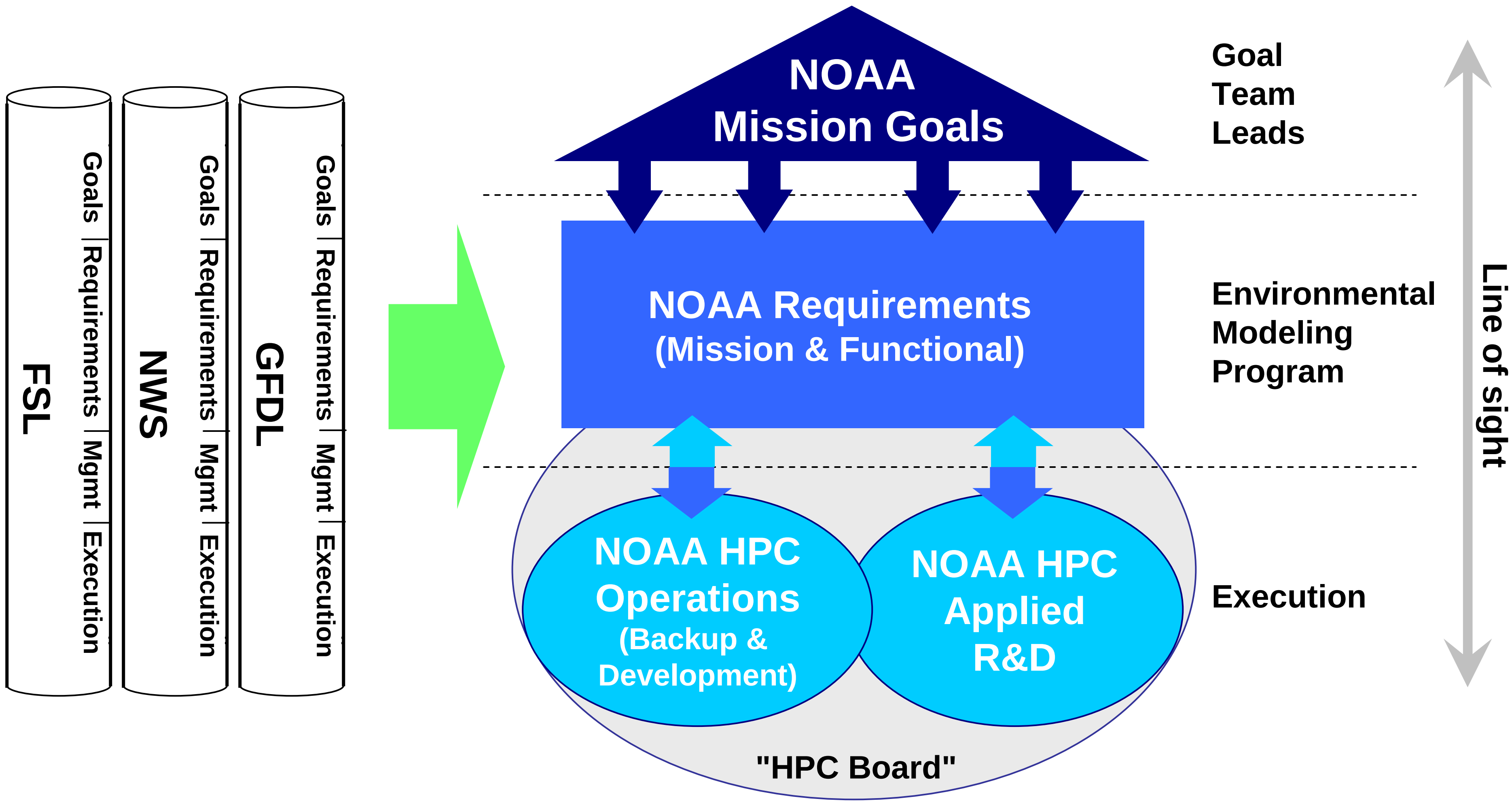
HPC strategic objectives

- All NOAA R&D computing available to all NOAA users nationwide
- Integrated HPC management
- Requirements managed NOAA-wide
- Function based HPC architecture (vs. organization based)
- Function based acquisitions (vs. organization based)

HPC Goal: Stovepipes to integrated management

Past State:
Stove piped HPC

Emerging:
Integrated management, functional alignment

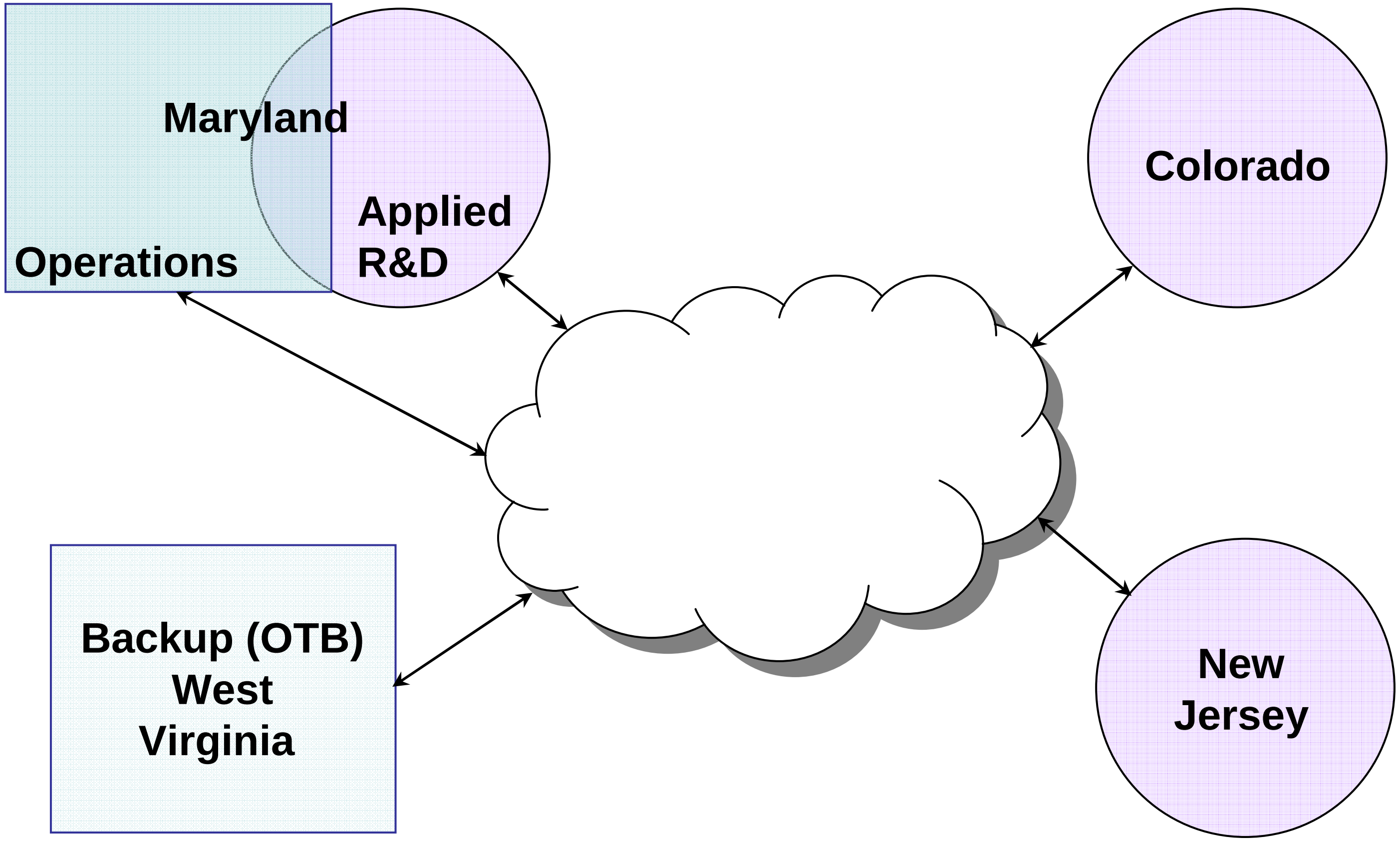


Strategy overview - Function based HPC acquisitions (vs. org based)

- One RFP for Operations and Backup

- One RFP for NOAA Applied R&D

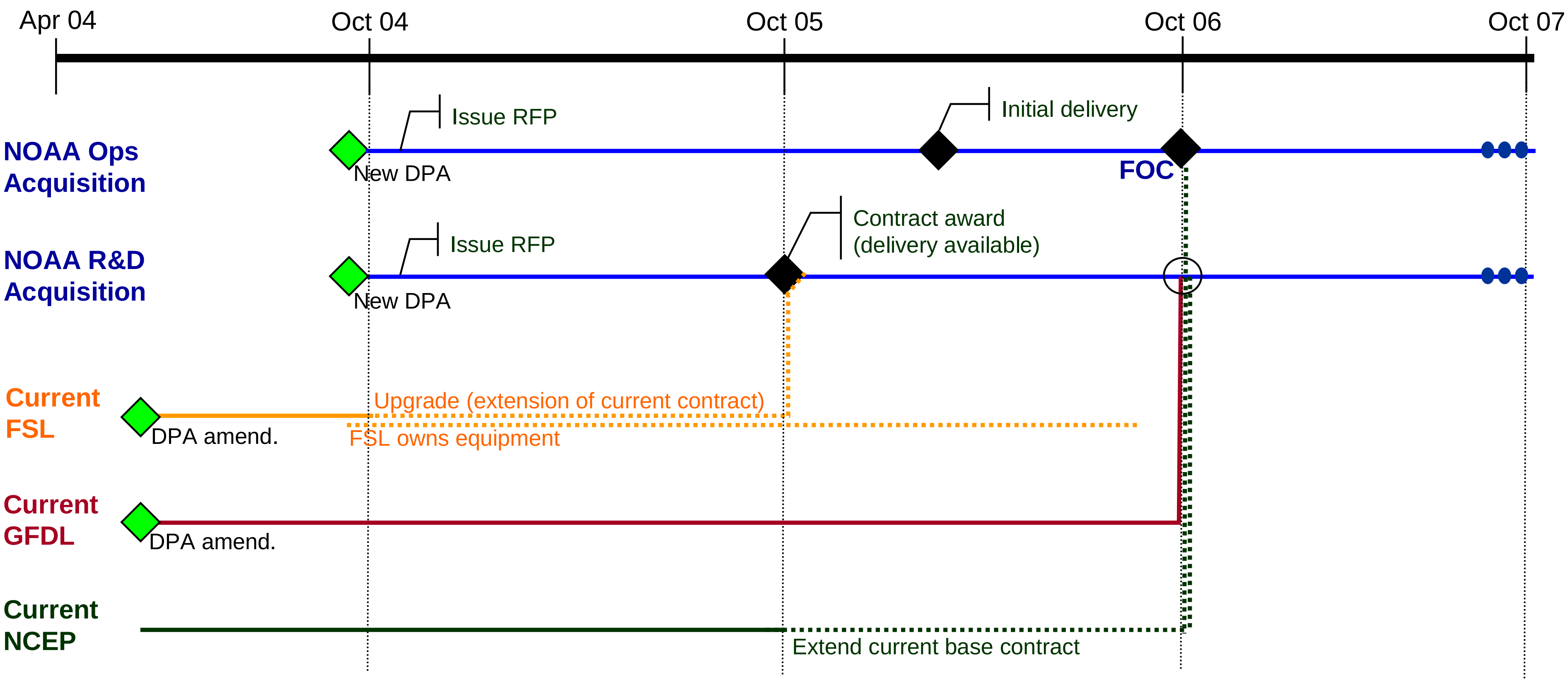
Fiscal Year 2005 topology



= Operations architecture
(includes operational test bed)

= Applied R&D architecture
(includes developmental test bed)

Acquisition strategy



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