



# ***NWS Science and Technology Roadmap***

## ***Advanced Forecaster Tools and Applications***



# *Team Composition*



- **Steve Pritchett, OST—Team Leader**
- **Wendy Levine, SPP—Contributor**
- **Roger Pierce, OAR/PPE—Contributor**
- **Greg Mann, WFO Detroit SOO (ISST Chair) —Contributor**
- **John Gaynor, OAR - Contributor**
- **Ken Graham, WFO New Orleans MIC—Contributor**



# ***Vision/Benefits/Impacts***

- **Team Vision**

- “Smart Systems” provide forecast aids and tools to NWS forecasters, that maximize forecaster effectiveness by focusing efforts on difficult forecast challenges; customer needs; and responsiveness to high impact events.

- **Benefits**

- Forecasters have increased situational awareness and expertise during high-impact events
- Forecasters have increased focus and capacity for decision support services to fully engage in providing the best advice to meet users needs
- Increase consistency of products/services across country

- **Impacts**

- Improved forecast/warning accuracy and lead time for high-impact events to save lives and mitigate loss of property
- Increased interactive communications with decision makers to ensure best response and outcome during high impact events
- Increased economic productivity/efficiency due to environmental decision support services to the public sector



# Goals/Targets: Emerging Science & Technology

Goal/Target	Outstanding Issues
Apply state of the art science/technology to support enhanced visualization and rapid interpretation of hydrometeorological data, automated decision assistance, and streamlined product preparation.	Complex information assimilation required for efficient and effective data mining
Build smart systems that utilize social science principles, including human factors and knowledge of societal impacts.	Lack of integration of hydrometeorological expertise with social science principles



# Goals/Targets: Customer Needs

Goal/Target	Outstanding Issues
Enhance forecaster coordination and collaboration throughout the forecast process.	Existing tools do not provide adequate methods for ensuring consistency across multiple offices.
Build systems and tools to aid forecasters in understanding and responding to customers needs.	This goal is being addressed by the DSS teams. No further breakdown of information will be provided in this roadmap, for this goal.



# Key Information Gaps

Gap	Solution Alternative	Impact
<p>1. Lack of forecaster workstation tools for advanced data visualization/interpretation.</p>	<p>1.1 Implement and incrementally improve AWIPS 2, based on technological opportunity</p> <p>1.2 All data/products available in integrated GIS tool on forecast workstation</p> <p>1.3 3-D Visualization of Hydrometeorological Data</p>	<ul style="list-style-type: none"> <li>• Improved diagnostic and analysis elements of the forecast process</li> </ul>
<p>2. Inadequate tools to assist with forecast investigation, prioritization, and decision-making in the forecast process.</p>	<p>2.1 Automated transfer of site-specific hydrometeorological knowledge – knowledge integration tools</p> <p>2.2 Implement hazardous weather forecast assistance systems currently under development (e.g., Four-Dimensional Stormcell Investigator)</p> <p>2.3 Investigate expert systems/forecast assistance techniques based on neural networks/fuzzy logic—to perform “metwatch” function and identify where forecaster needs to apply attention.</p>	<ul style="list-style-type: none"> <li>• Smart system performs “triage” to identify areas of uncertainty, where forecaster needs to apply greater attention.</li> <li>• Leads to improvements in forecast accuracy/lead time</li> </ul>



# Key Information Gaps

Gap	Solution Alternative	Impact
3. Lack of state of the science tools for product preparation.	3.1 Next Generation Warning Tool 3.2 Interactive tools to support NextGen 4-D database preparation	<ul style="list-style-type: none"><li>• Improvements in forecast accuracy/lead time</li><li>• More forecaster time spent on expert interpretation and communication of forecast situation</li></ul>
4. Inability to experiment with new scientific methods and forecaster processes, in a pre-operational mode.	4.1 Implement experimental forecast facility/test bed to experiment with new scientific methods and roles for the forecaster in a quasi-operational setting	<ul style="list-style-type: none"><li>• Reduce costs associated with refining scientific methods and forecaster roles. Ability to make key changes prior to nationwide implementation.</li></ul>



# Key Information Gaps

Gap	Solution Alternative	Impact
<p>5. Insufficient use of social science principles in forecaster tools and applications, including human factors and knowledge of societal impacts.</p>	<p>5.1 Address assessments/recommendations from social science-based studies (human factors and societal needs), and determine how best to implement changes from an S&amp;T perspective.</p> <p>5.2 Improved agency science and technology infusion processes to allow forecasters to rapidly take advantage of advances in science/technology</p>	<ul style="list-style-type: none"> <li>• Capitalize on strengths of our human capital while automating those processes which can be automated</li> </ul>
<p>6. Inadequate tools for forecaster collaboration and consistency.</p>	<p>6.1 Chat/collaboration tools fully integrated into operational workstation and used consistently across NWS</p> <p>6.2 Incorporate social networking applications for sharing of information and situational awareness</p> <p>6.3 Introduce research for development of advanced collaboration tools</p>	<ul style="list-style-type: none"> <li>• Collaboration throughout forecast process will lead to improvements in forecast consistency</li> </ul>



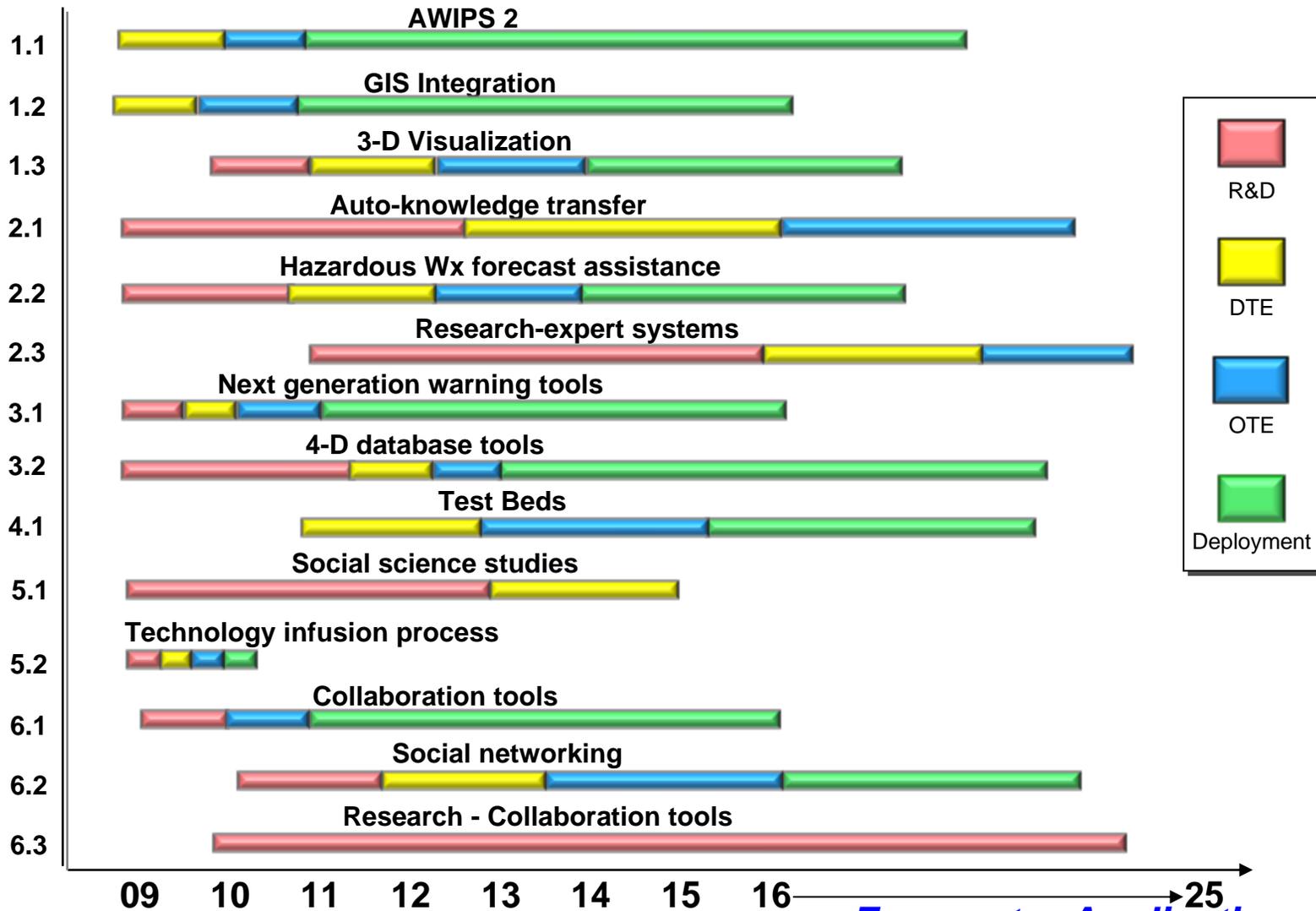
# Research Needs and Opportunities



- **Short, Mid-term**
  - Social Science studies/assessments
  - How to best introduce change and acculturate staff to new tools/techniques/processes
  - Social networking tools
  - Improved workstation data visualization/integration tools
- **Long-term**
  - Enhanced workstation data visualization/ integration tools
  - Expert systems (Neural networks; fuzzy fusion)
  - Advanced collaboration tools, e.g., use of virtual reality for enhanced situational awareness during collaboration

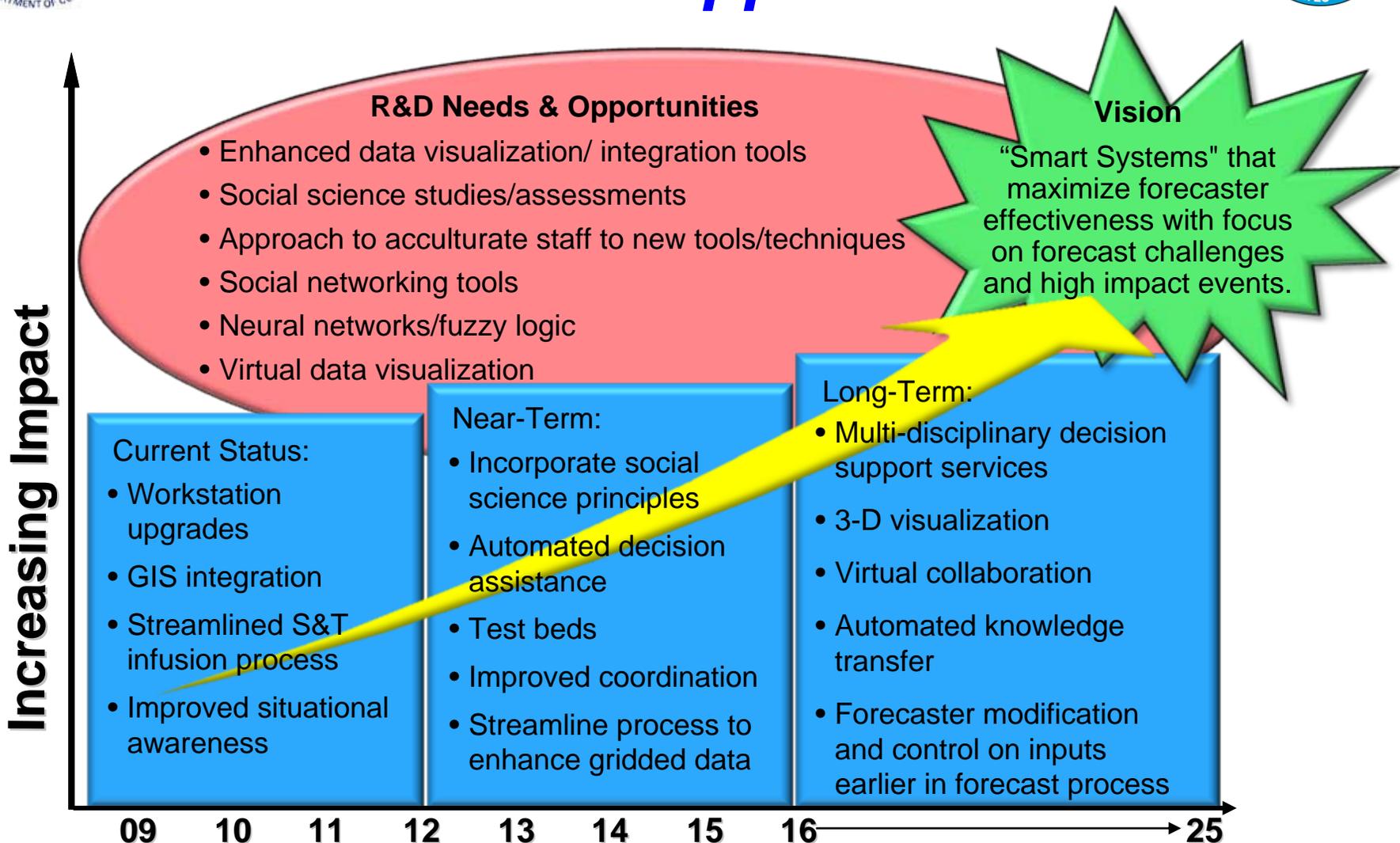


# Forecaster Applications Alternative Solutions





# Focus Area Team Summary: Forecaster Applications





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### ***Additional Information***



# Target Performance Measures: Advanced Forecaster Tools and Applications

Proposed	Current (2009)	FY 2016 Target Example	FY 2025 Target Example
<p>Reduced time spent on diagnosis/analysis in forecast process;</p> <p>Reduction in percentage of time spent preparing forecasts (e.g., grid editing);</p> <p>Less time spent is preparing hazardous weather warnings;</p> <p>Increase in time spent providing DSS</p>	No baseline	Establish baseline	10% reduction in time spent in data analysis, diagnosis and forecast product preparation, with additional time spent on decision support services.
Increase in customer satisfaction scores	No baseline	Establish baseline	10% increase in customer satisfaction scores.
Science and technology enhancements keep pace with S&T developments	No baseline	Establish baseline; Decrease in RTO time by 5 %	Decrease in R2O time by 10%
Chat/coordination tools implemented/used at all NWS forecast offices	NWS-Chat used at 99 offices. 12 Planet used on AWIPS for internal coord.	Used at all NWS offices	Used at all NWS offices



# Target Performance Measures: Advanced Forecaster Tools and Applications

Proposed	Current (2009)	FY 2016 Target Example	FY 2025 Target Example
Increased usage of NWS-chat during high-impact weather events	Establish baseline	Increase usage by 5% of baseline	Increase usage by 10% of baseline
Increased consistency in NWS forecasts across NWS sites.	No baseline	Establish baseline	10% increase
Increase in verification scores for new forecasters within 6 months of use of new knowledge integration tool.	None	None	5% increase
Increase in hazardous weather warning lead times.	See severe weather program area	See severe weather program area	See severe weather program area
Impact of fuzzy logic/neural networks.	None	Establish baseline	Positive incremental improvements in accuracy of NWS forecasts.
# of proposed methods/capabilities/year for analysis and decision	None	Analysis and decision of 5 proposed methods/capabilities/year	Analysis and decision of 10 proposed methods/capabilities/year