1st SEVERE WEATHER WARNING TECHNOLOGY WORKSHOP (July 2005)

Overall Summary: NWS forecasters led discussion in small breakout groups on evaluating current shortcomings and proposing ideas for critical future improvements in threat interrogation and warning dissemination/management. There is a lot of overlap in these brainstorming sessions, so the section summaries are provided to consolidate results for the appropriate topic. Some of the ideas in this section will be refined and proposed to appropriate requirements groups.

The **objective** of *Breakout Session Part I* is to **outline and rank the most important current shortcomings** of each of the sub categories.

- Weather Threat Interrogation (Groups A, B, and C):
  - Displays and Data Sources
  - Algorithms/Applications/Decision Support
  - Operations/Methodologies

- Warning Dissemination and Management (Groups D, E, and F):
  - Warning Generation and Products
  - Integration with Partners and End Users
  - Verification and Evaluation

The **objective** of *Breakout Session Part II* is to **outline ideas for critical future improvements** of each of the sub categories.

- Weather Threat Interrogation (Groups A, B, and C):
  - Displays and Data Sources
  - Algorithms/Applications/Decision Support
  - Operations/Methodologies

- Warning Dissemination and Management (Groups D, E, and F):
  - Warning Generation and Products
  - Integration with Partners and End Users
  - Verification and Evaluation

Day 1: Outline and rank the most important shortcomings
Section 1: Weather threat interrogation
Question 1: Displays and Data Sources

Summary:
Weather threat interrogation displays and data sources can benefit from improvements in quality of near storm environment information, radar base data analysis tools, spotter input, radar base data spatial and temporal resolution, situation awareness displays, and display customization and real estate.

Day 1: Outline and rank the most important shortcomings
Section 1: Weather threat interrogation
Question 2: Algorithms/applications/decision support

Summary: Current algorithms can benefit from improvements in the accuracy of detections, tracks and trends, product latency (need before end of volume scan), and providing more useful information. Many offices rely upon base data analysis interpreted by experienced forecasters for primary decision making, with algorithms as a safety net (with holes) or as reinforcement of what is already known. In the future, different algorithms need to be considered, with emphasis placed on multi-sensor integration, inclusion of intermediate output to help build expertise, and new product paradigms. Applications and decision support systems need improvement to include integration between base data, algorithm guidance, and intermediate outputs. Improvements in annotation tools and devices (such as light pens) are also needed.

Day 1: Outline and rank the most important shortcomings
Section 1: Weather threat interrogation
Question 3: Operations/Methodologies

Summary: Operations and methodologies for threat interrogation can benefit from improvements in data resolution, workload management, and operational tools. Improvements are needed in staffing, partial backup, utilizing a storm coordinator, situation awareness displays, spotter integration, and raw data management.

Day 1: Outline and rank the most important shortcomings
Section 2: Warning Dissemination and Management
Question 4: Warning Generation and Products

Summary: Warning generation and products can benefit from improvements in communication (graphic products, clearer messages, conveying uncertainty with probabilities), workload management (staffing, situation awareness displays of products issued, discontinuing old products, graphical coordination tools with partners), product creation (buggy software, too many separate warning applications, inadequate maps, bad storm motion estimates, LSR creation), dissemination (multiple formats, multi-lingual), and policy (better definitions and guidance on convective versus non-convective threats).

Day 1: Outline and rank the most important shortcomings
Section 2: Warning Dissemination and Management
Question 5: Integration with Partners and End Users

Summary: One of the keys to improving warning effectiveness is better integration with partners and end users. Current integration can benefit from improved understanding of users/partners (roles and diversity), relationships with media/EMs (needs to be stronger), external awareness of disaster response (need SA displays), communication capabilities (products not flexible for spectrum of needs, user education needed), and workload management.

Day 1: Outline and rank the most important shortcomings
Section 2: Warning Dissemination and Management
Question 6: Verification and Evaluation

Summary: Improving verification and evaluation can enhance our ability to understand NWS public service and guide future initiatives. Improvements are needed in measuring impacts of products on customers, measuring response to products, measuring perception of products, collecting accurate and comprehensive verification (include measuring threat), evaluating new techniques/tools (proving ground and/or shadow office capability), using verification constructively to improve performance.

Day 2: Outline and rank ideas for critical future improvements
Section 1: Weather threat interrogation
Question 1: Displays and Data Sources

Summary: There are a lot of areas for improvement in displays and data sources used for NWS weather threat interrogation. Future improvements should consider improving warning "base" data inputs (more radars, faster VCPs, higher spatial resolution radar data, more and better spotter input, NSE datasets like SPC mesoanalysis), analysis tools (increased frame counts for all-tilts, all-tilts navigation improvements, FSI, situation awareness displays, web cams), techniques (mouse over data disclosure, storm centric base radar displays, easy access to highest resolution radar, virtual radar data volumes), GIS (real-time geographic analysis tools, GIS-friendly products, and better background maps), and hardware (more and larger screens).

Day 2: Outline and rank ideas for critical future improvements
Section 1: Weather threat interrogation
Question 2: Algorithms/applications/decision support

Summary: Future algorithms/applications/decision support systems should focus on improving base-data oriented analysis in a way that saves forecaster time. Extra attention needs to be paid to human factors and effectiveness. Considerations for improvement should include proven WDSSII functionality (FSI, regional multi-sensor, time-ht reflectivity/divergence profiles, continuous pan and zoom), situation awareness tools (like SADS), short term forecast improvements (like Autonowcaster), training (more robust with developer participation, testbed capabilities for new techniques/tools, practice workstations on live data from other WFOs), and tools to support dual polarization radar.

Day 2: Outline and rank ideas for critical future improvements
Section 1: Weather threat interrogation
Question 3: Operations/Methodologies

Summary: Future threat interrogation operations and methodologies need to stay on the edge of technology. Speed, efficiency, and stability are all critical factors. Improvements should be centered around multi-sensor base-data interrogation methods for convective warnings and short term forecasts. The analysis needs to be integrated with geographic information (GIS tools and data sets) to provide effective public service. Creative solutions for workload support need to be explored. Robust training will be essential for new technologies.

Day 2: Outline and rank ideas for critical future improvements
Section 2: Warning Dissemination and Management
Question 4: Warning Generation and Products

Summary: Future warning generation and products should consider improvements to warning creation tools (better geographic analysis capabilities), graphical products (geospatial probabilistic threat information), warning management (more resources, situation awareness methodologies and displays), training on new tools (including implementing a proving ground concept, and improvements on utilizing existing requirements processes to understand and prioritize.

Day 2: Outline and rank ideas for critical future improvements
Section 2: Warning Dissemination and Management
Question 5: Integration with Partners and End Users

Summary: Future warning effectiveness can be improved with stronger partner relationships and tools to support interactive collaboration. Future integration with partners and end users should consider flexible products (variety of formats, geo-referenced/GIS ready, multi-lingual, allowing increased dissemination), using a multi-layered approach to probabilistic warning information to allow users to threshold based on risk, increasing the speed to market of new services and formats, improving situation awareness tools at WFOs, dedicating resources for improvement, and raising visibility of NWS.

Day 2: Outline and rank ideas for critical future improvements
Section 2: Warning Dissemination and Management
Question 6: Verification and Evaluation

Summary: While improvements to current measures can be beneficial, we also need to move beyond traditional measures of verification and performance to find better measures of public service. Improvements to verification and evaluation should consider including customer service/satisfaction, impacts (including savings to life and property), multi-layered verification (threats, observations, and probabilistic approaches), better real-time monitoring of products at WFO, a proving ground/shadow office and/or WFO experimental testbeds to test new techniques/tools, and more robust and expansive verification sources.