



February 20, 2018
NCST Advisory
Committee Meeting

NOTE – Summaries of the recommendations are included in the following slides for context. The complete recommendations are available in the final report of the NIST Technical Investigation of the Joplin Tornado, at <https://dx.doi.org/10.6028/NIST.NCSTAR.3>

Update on Implementation of Recommendations from the Joplin Tornado Investigation

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List of Joplin Recommendations

	R #	RECOMMENDATION SUMMARY
Hazard Characteristics	1	Development and deployment of technology to measure tornado wind fields
	2	Archival of tornado event data
	3	Development of tornado hazard maps
	4	Improvement of EF Scale; means for continued improvement; adoption by NWS
Buildings, Shelters, Designated Safe Areas, and Lifelines	5	Development of performance-based standards for tornado-resistant design
	6	Development of performance-based tornado design methodologies
	7	a) Development of tornado shelter standard for existing buildings; b) Installation of tornado shelters in more buildings in tornado-prone regions
	8	Development of guidelines for public tornado sheltering strategies
	9	Development of guidelines for selection of best available refuge areas
	10	Prohibition of aggregate coverings or ballast in tornado-prone regions
	11	Development of requirements for enclosures of egress systems in critical facilities
	12	a) Development of tornado vulnerability assessment guidelines for critical facilities; b) Performance of vulnerability assessments by critical facilities in tornado-prone
Emergency Communication	13	Development of codes, standards, and guidance for emergency communications; Development of joint plan by emergency mgrs/media/nws for consistent alerts
	14	Deployment of “push” technologies for transmission of emergency information
	15	Research to identify factors to enhance public perception of personal risk
	16	Develop technology for real-time, spatially-resolved tornado threat information



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	R #	RECOMMENDATION SUMMARY UPDATES
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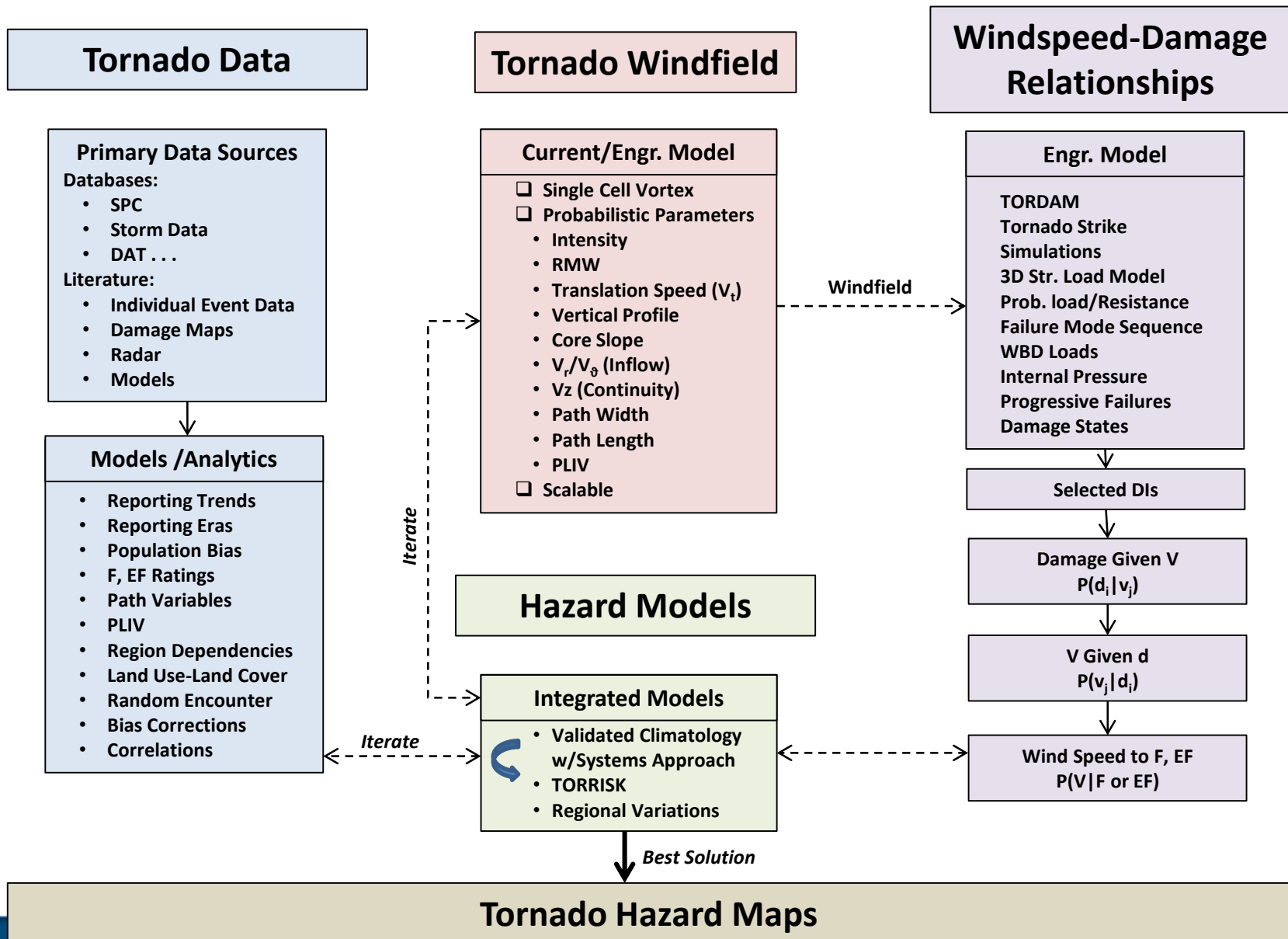
Progress – Tornado Hazard Maps (1/2)

R3: Development of tornado hazard maps for use in the engineering design of buildings and infrastructure, considering spatially based estimates of the tornado hazard instead of point-based estimates.

- **Update highlights since September 2017 NCSTAC meeting**
 - Developed and tested a method to account for population bias in tornado reporting to estimate true tornado occurrence rates
 - Confirmed through tornado data analysis a hypothesis identified in the literature that tornadoes with longer paths have higher translational speeds
 - Developed code-based analyses for common EF Scale Damage Indicators (Free Standing Poles and Free Standing Towers) to support wind speed probability analysis for given EF ratings
 - Awarded Year 4 Task Order (Sept 2017) to ARA for completion of the maps and associated report
- **NIST has initiated planning for 2nd Tornado Map Stakeholder Workshop**
 - Purpose: Present draft maps/underlying methodology to ASCE 7 committee and other stakeholders, and obtain feedback prior to submission of formal proposals
 - Anticipated for late 2018 or early 2019, in combination with an ASCE 7 Wind Load Subcommittee meeting



Tornado Map Development Process



Progress – Tornado Hazard Maps (2/2)

R3: Development of tornado hazard maps for use in the engineering design of buildings and infrastructure, considering spatially based estimates of the tornado hazard instead of point-based estimates.

- **Executed Interagency Agreement with the Nuclear Regulatory Commission for NIST to provide high wind analysis (Aug 2017)**
 - Evaluate epistemic uncertainties associated with main components of the tornado wind speed risk modeling process:
 - tornado occurrence rates • reporting efficiency and population bias modeling • tornado data analysis and bias corrections • wind speed analysis and probabilistic wind speed distribution modeling from EF damage ratings
 - Propagate uncertainties to produce derived mean tornadic wind speeds
 - Produce maps that reflect aleatory and epistemic uncertainties for point strike probabilities and strike probabilities for multiple spatial scales
 - Awarded Task Order to ARA (Feb 2018)
- **Results of this new project will benefit ongoing development of tornado maps and load provisions for ASCE 7-22 and ICC 500-2020**

Progress – PBD / Design Methodologies

R5: Development of performance-based stds for tornado-resistant design

R6: Development of performance-based tornado design methodologies

Efforts related to the ASCE 7-22 Wind Load Subcommittee (WLSC)

- **The ASCE/SEI Ad-hoc Committee on PBD for Wind Hazards, which NIST co-led, has now been folded into the ASCE 7-22 WLSC**
 - Plan to add provisions to ASCE 7-22 that enable PBD for wind hazards, including tornadoes
 - Planned development of ASCE guidance document for Wind PBD
- **NIST is chairing a new WLSC Tornado Task Committee**
 - First meeting - Jan 2018
 - Developing tornado maps/provisions for existing return periods used in ASCE 7 Chapter 26 basic wind speed maps
 - Developing tornado maps and load provisions for higher return periods to support Tornado PBD
 - Developing higher return period non-tornadic wind speed maps needed for Wind PBD

Progress – Tornado Shelter Standard

R7a: Development of tornado shelter standard for existing buildings

- ICC has agreed to expand the scope of the existing *ICC 500, Standard for the Design and Construction of Storm Shelters*, to incorporate retrofits of tornado shelters in existing buildings
- NIST and FEMA collaborated on submission of 10 proposals for ICC 500-2020 (Dec 2017), including provisions for
 - Evaluation of existing slabs on grade for the applicable loads
 - Risk category determination
 - Revised scope and charging language for Structural Loads chapter
 - Rainfall rate and rainwater drainage
- ICC 500 Cmte. will be appointed in April, w/publication deadline of Dec. 1 2020 to become the referenced standard in the 2021 I-Codes
 - NIST will leverage its significant efforts underway in tornado mapping and loading mechanisms for ASCE 7-22 to submit additional proposals



Progress – Public Tornado Sheltering Strategies (1/2)

R8: Development and implementation of uniform national guidelines that enable communities to create safe, effective public sheltering strategies

- **NFPA 1616-2017: Standard for Mass Evacuation, Sheltering, and Re-entry Programs - NIST developed all building safety-related material in the standard and annexes**
 - Requirements for consideration of building safety in shelter selection criteria
 - Requirements for sheltering facilities to be deemed appropriate for temporary occupancy of evacuees for the applicable hazards by the AHJ
 - Annex guidance for shelter and best available refuge area selection
 - Checklists to aid in shelter assessment process



Progress – Public Tornado Sheltering Strategies (2/2)

NFPA 1616-2017 Annex Guidance

- **General**

- Minimum Recommendations for Selection of Existing Buildings
- Minimum Recommendations for Construction of New Sheltering Facilities
- Considerations for Shelter Exposure to the Hazard Event
- Considerations for Post-event Shelters

- **Risk and Condition Assessments**

- Pre-event Risk Assessment supporting shelter selection
- During-event Risk Assessment
- During-event Condition Assessment
- Post-event Condition Assessment

Explicit guidance on shelters for specific hazards

Tornadoes
Hurricanes
Snow/Winter Storms
Floods
Tsunamis
Earthquakes

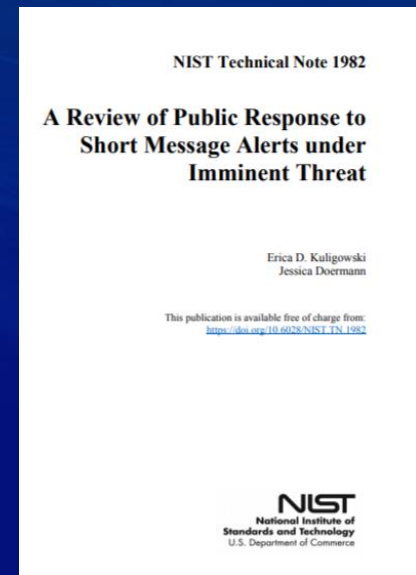


Progress - Emergency Communications

R13: Development of national codes, standards and guidance for clear, consistent, recognizable, and accurate emergency communications, encompassing alerts and warnings, to enable safe, effective, and timely responses among individuals, organizations, and communities in the path of storms having the potential to create tornadoes.

NIST Project: Development of guidance for community-wide public alerts in emergencies
Year 2 focus: Short message alerts (e.g., wireless emergency alerts and Twitter)

- **Workshop with short message alert “super users” (Sept 2017)**
 - Obtained insights on NIST’s interim guidance on short message alerts
- **NIST Technical Note on short message alerting (Jan 2018)**
 - Reviews current status of short message alerting
 - Discusses usage from alert originators and the public
 - Literature review of public response to short message alerts
- **Developing new short message templates**
 - To aid with expanded-length WEA messages
 - Now 360 characters, up from previous 90 character limit
- **Proposing incorporation into NFPA 1600**
 - Will present study findings during March 2018 committee mtg





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Updates on Joplin Recommendations

Questions?

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