Traffic Flow Management (TFM) Post-Event Analysis

Len Wojcik

703-983-6590 • lwojcik@mitre.org

MSR

MITRE Technology Program

Problem

- Current Traffic Flow Management (TFM) decision making does not explicitly account for weather forecast uncertainty.
- Decision analysis is a well-established method to account for information uncertainty.
- Application of decision analysis to the complex U.S. TFM system is very challenging.
- Can the decision analysis perspective be applied to create a useful decision support tool for TFM post-event analysis (and ultimately for real-time decision support)?

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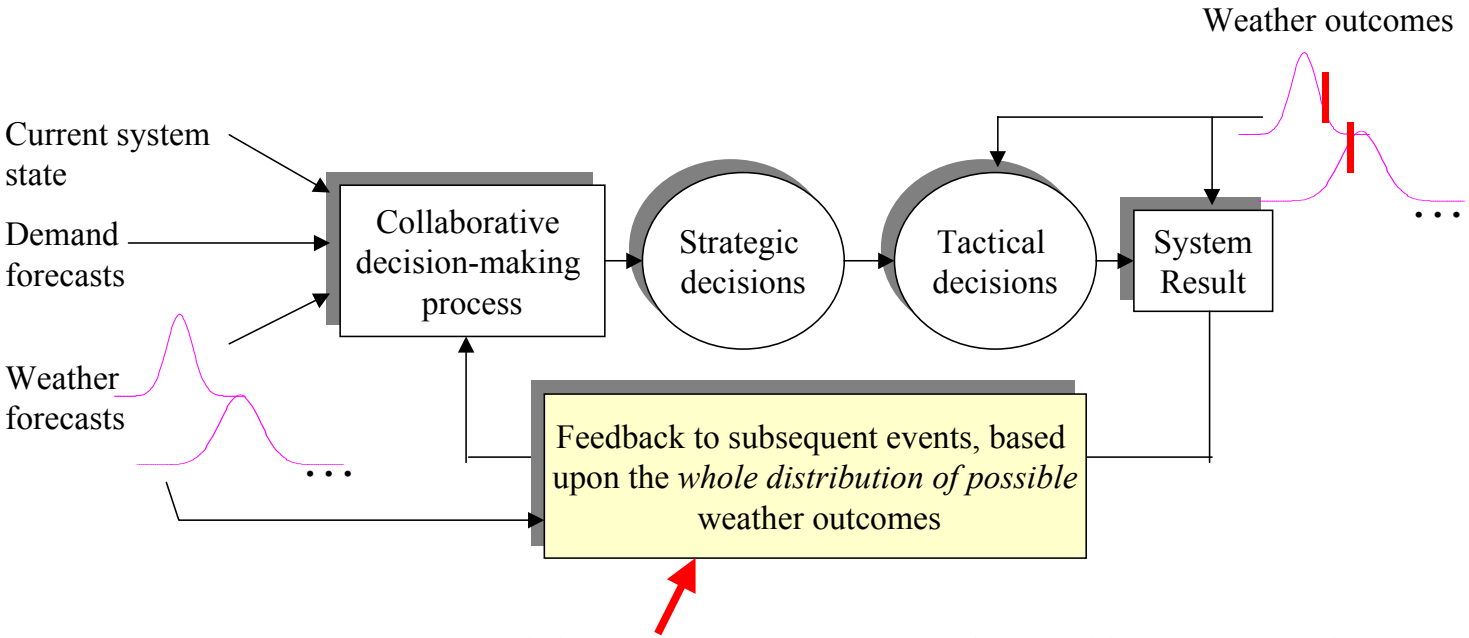
Background: TFM Decision-Making



This is the TFM post-event analysis capability we are working on in this MSR

- **Eventually, this could become a real-time decision-support capability**
- **Eventually it could incorporate demand uncertainty**

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Objectives

- Create a useful TFM post-event analysis tool
- Provide a basis for “probabilistic TFM,” which attempts to better account for uncertain information in TFM decision-making
  - Future weather, capacity and demand are all uncertain
- Ultimately, provide a real-time TFM decision support capability

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Activities

- Present conference papers on an agent-based simulation of the approach ✓
- Create a simple initial demonstration of the approach on a Bayesian network for a single TFM operational scenario type ✓
  - Choose a scenario type: NY/Penn en-route weather events ✓
  - Populate with data from actual events ✓
  - Supplement with subjective judgements ✓
- Expand the network to include the time sequence of decisions
- Expand the network geographically to encompass a level of complexity that provides useful support for post-event analysis and (ultimately) real-time decision support

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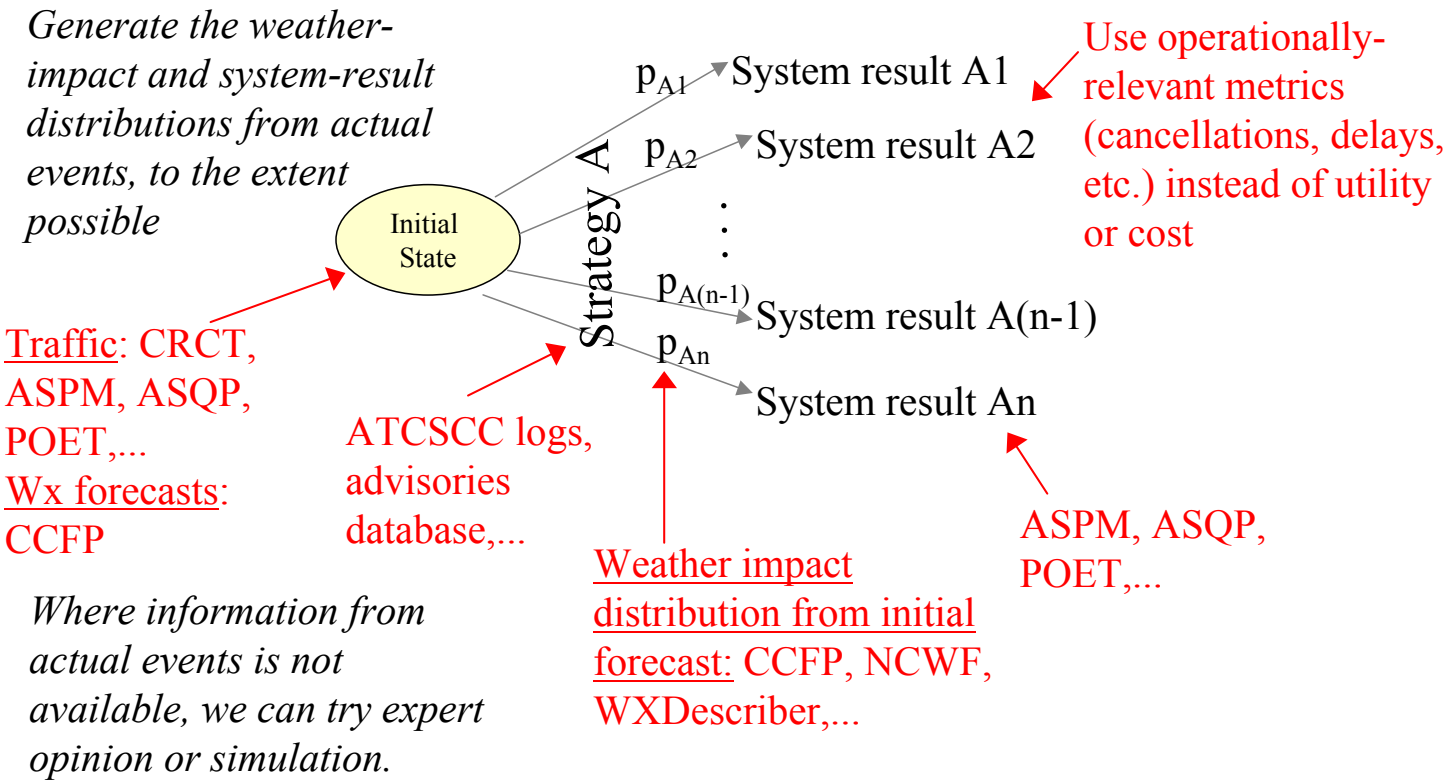
Highlight:
The Approach and Data Sources



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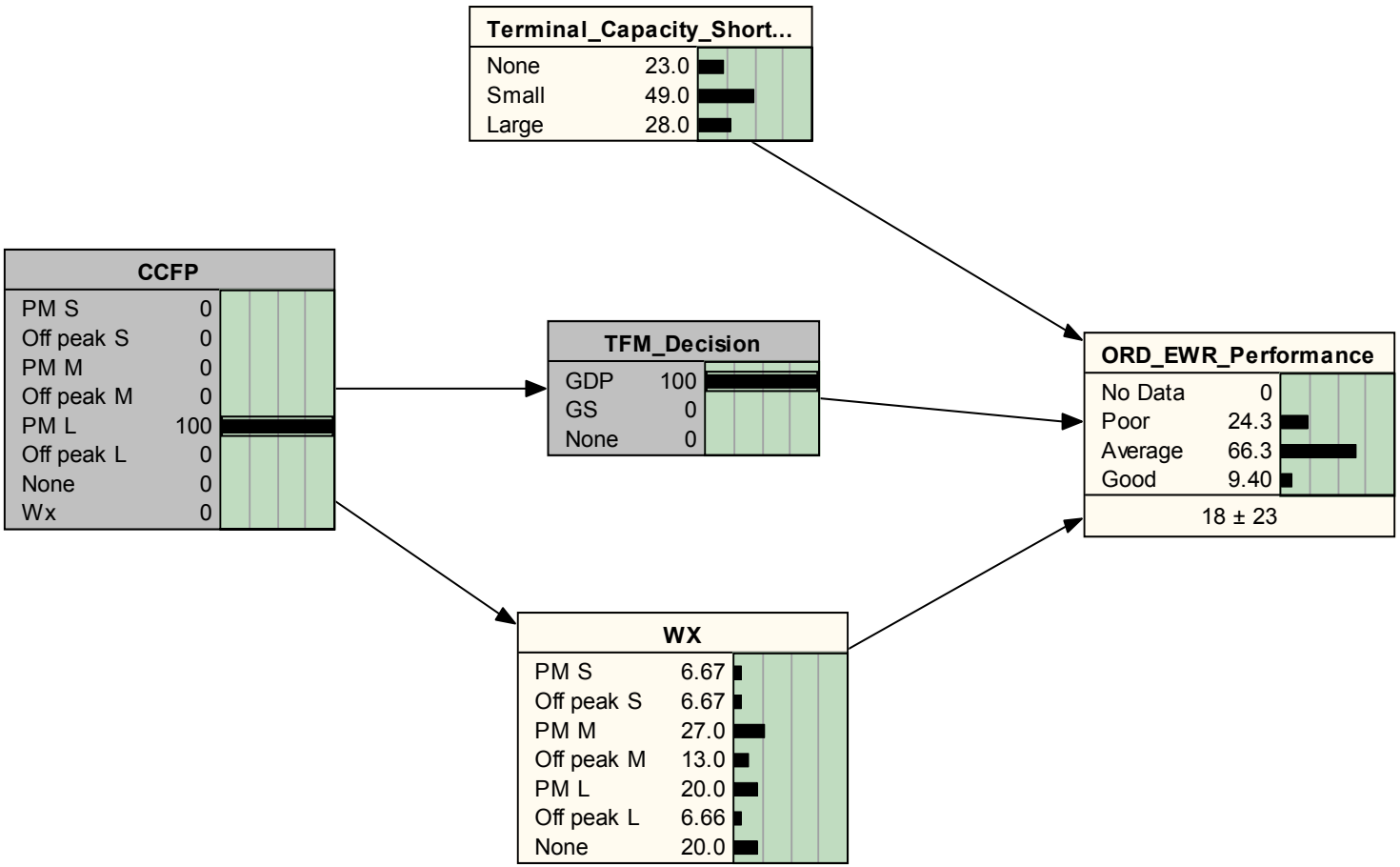
Highlight/Demonstration



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Impacts

- Fundamentally improve TFM decision-making, to the benefit of the flying public
- Successful application of decision analysis to the formidable TFM problem will provide lessons learned for other decision-making domains.
- Public presentations and publications
  - L. A. Wojcik, “Three Principles of TFM Decision-making Interactions,” presented at the 4th USA/Europe Air Traffic Management R&D Conference, December 2001; paper at http://atm2001.eurocontrol.fr/finalpapers/pap145.pdf.
  - L. A. Wojcik, “Simple and Complex Models of Air Traffic Flow Management Decision-making Interactions,” presented at the First Joint Symposium of the Washington D.C. Chapter of the Institute for Operations Research and the Management Sciences (WINFORMS), March 2002.

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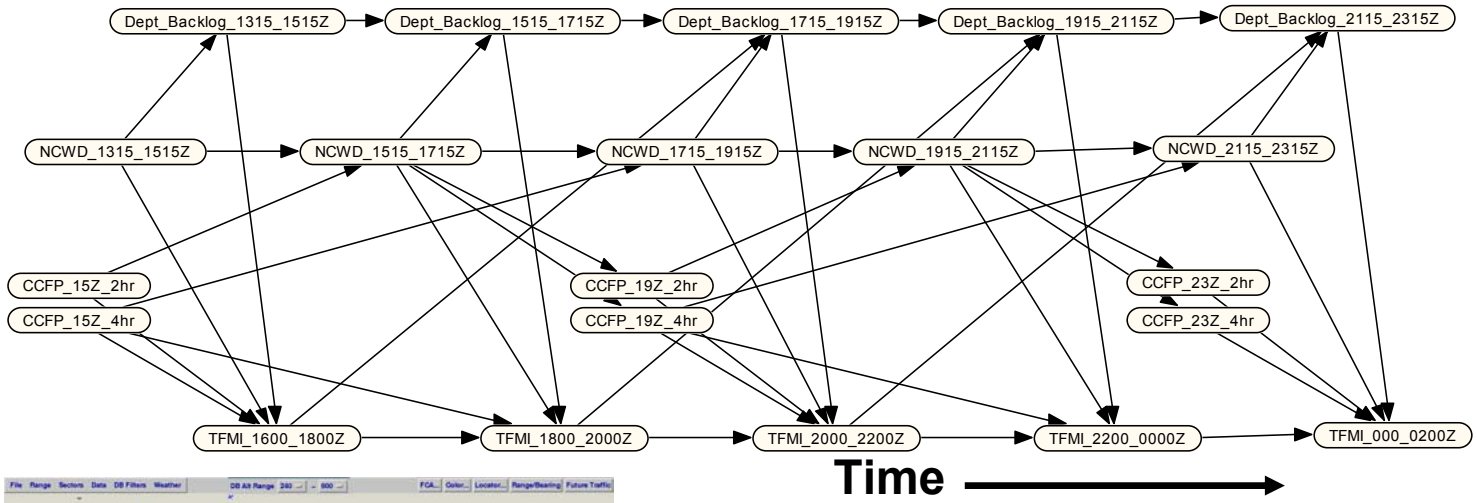
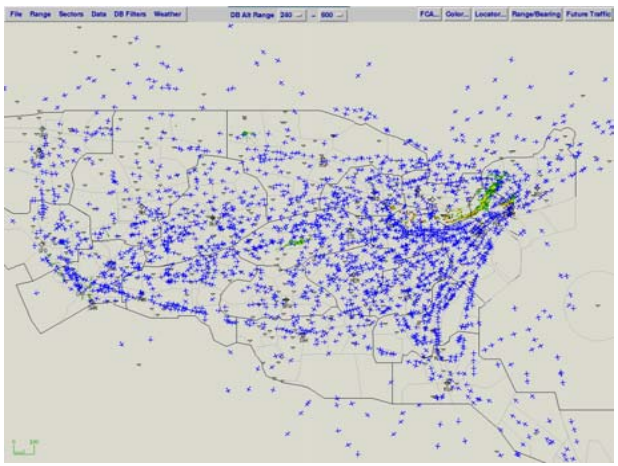
Future Plans





1. Expand the Bayesian network in time and geography
2. Show its utility as a TFM post-event analysis tool
3. Ultimately, develop a real-time TFM decision support capability

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