All-Weather Decision Support Planning Workshop
Traffic Flow Management (TFM) Session

Collaborative Routing Coordination Tool (CRCT)

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CRCT Weather Problem Resolution Overview

- FY98 - identified issues involving TFM weather problem resolution
- FY99-00 - conducted MITRE sponsored research
  - Developed CRCT weather problem resolution functionality using National Convective Weather Forecast (NCWF)
- FY00 - initiated daily use and operational evaluation of baseline CRCT at ATCSCC, ZID and ZKC
- FY01 - begin field evaluations of CRCT weather problem resolution by leveraging the FAA’s daily use of baseline CRCT
Severe weather is predicted to impact adjacent sectors in ZMP, ZAU and ZKC. Flights impacted by severe weather are identified. The Traffic Management Specialist (TMS) designates reroutes around the weather-impacted area. TMS evaluates weather reroutes and conducts collaboration with airlines and ATC personnel.
CRCT Severe Weather Operational Needs

• Weather is the leading cause of delays in the NAS and these weather-related delays appear to be on the increase (e.g., 22% in 1999)
  – Recommended by RTCA 03-05 as high priority R&D

• Fortunately, CRCT (i.e., baseline version)
  – Allows weather FCAs to be manually drawn
  – Automates aircraft/weather conflict detection
  – Provides tools for users to manually reroute individual or groups of aircraft around weather impacted areas

• However, baseline CRCT does not
  – Interface with sources of severe weather forecasts
  – Automate rerouting of aircraft around weather
CRCT Severe Weather Operational Needs (concluded)

- If TFM DS can not adequately address weather-related flow restrictions, other tools that may unduly restrict traffic flow and involve more aircraft than necessary are employed
  - Miles-In-Trail (MIT)
  - Ground Delay Programs (GDP)
  - Ground Stop Programs (GSP)

- More efficient TFM tools are needed to:
  - Reduce aircraft weather delays and cancellations
  - Limit # of aircraft impacted by weather delays
  - Keep throughput around weather high
  - Reduce the need for more restrictive tools
CRCT Severe Weather Requirements

- **Type(s) of severe weather forecast data required**
  - Convective weather
  - Turbulence

- **Minimum forecast severity level**
  - What weather will en route pilots fly through? (FY01-MIT/LL)
  - What is TFM’s definition of severe weather? (FY01-MIT/LL)

- **Permeability of forecast area to air traffic**
  - Pilots may fly through an area forecasted for severe weather by tactically navigating around storm cells or they may find the storm impenetrable
  - What is TFM’s definition of aircraft permeable to severe weather? (FY01-MIT/LL)
CRCT Severe Weather Requirements (continued)

- **Vertical definition**
  - Under what conditions (if any) would aircraft be rerouted over (rather than around) forecasted severe weather? (FY02-MIT/LL & CAASD)

- **Minimum forecast accuracy**
  - Aviation specific metrics
    - North/South storm extent? (FY01-CAASD)
    - East/West storm extent? (FY01-CAASD)
  - Traditional forecast skill metrics
    - Probability of Detection (POD)? (FY01-CAASD)
    - False Alarm Rate (FAR)? (FY01-CAASD)
    - Forecast Bias (BIAS)? (FY01-CAASD)
    - Critical Success Index (CSI)? (FY01-CAASD)
CRCT Severe Weather Requirements (concluded)

- **Minimum forecast area**
  - What is the minimum horizontal forecast area of interest to TFM? (FY01-CAASD)

- **Forecast period and interval**
  - How far out in time does the forecast need to go and at what interval (e.g., hourly out 2-3 hours)? (FY01-CAASD)

- **Frequency of forecasts**
  - How frequently should forecasts be updated (e.g., 5, 10, 30, 60 minutes)? (FY02-CAASD)

- **Forecast stability**
  - How much predicted change is acceptable between successive forecasts? (FY02-CAASD)
## CRCT Weather Problem Resolution Plan

### Technology & Implementation Readiness Levels

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
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<tbody>
<tr>
<td>9</td>
<td>Operate Implementation Capability</td>
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<tr>
<td>8</td>
<td>Qualify Implementation Capability</td>
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<tr>
<td>7</td>
<td>Develop Implementation Capability</td>
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<tr>
<td>6</td>
<td>Define Requirements &amp; Transfer Technology</td>
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<td>5</td>
<td>Develop Plans &amp; Procedures</td>
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<td>4</td>
<td>Conduct Functional Demonstrations</td>
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<tr>
<td>3</td>
<td>Define Operational Concept</td>
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<tr>
<td>2</td>
<td>Define schedule, infrastructure, and Op Environment</td>
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<tr>
<td>1</td>
<td>Describe Proposed Capability</td>
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### R&D Program Goal

- **Prove System in Operation**
  - 06
  - TRL 9
- **Qualify System by Demonstration**
  - 05
  - TRL 8
- **Prototype in Operational Setting**
  - 04
  - TRL 7
- **Prototype in Relevant Setting**
  - 01-03
  - TRL 6
- **Validate Components in Relevant Setting**
  - 01-03
  - TRL 5
- **Validate Components in Laboratory**
  - 01-03
  - TRL 4
- **Perform Proof-of-Concept**
  - 00
  - TRL 3
- **Formulate Concept or Application**
  - 99
  - TRL 2
- **Observe/Report Basic Principles**
  - 98
  - TRL 1

**FAA Investment Decision**: 02