



AWIN Topical Study

Weather Avoidance Using Route Optimization as a Decision Aid

Cooperative Agreement NCC-1-362
(Follow- On to NCC-1-291)

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Weather Accident Prevention Annual Project Review
May 24, 2000

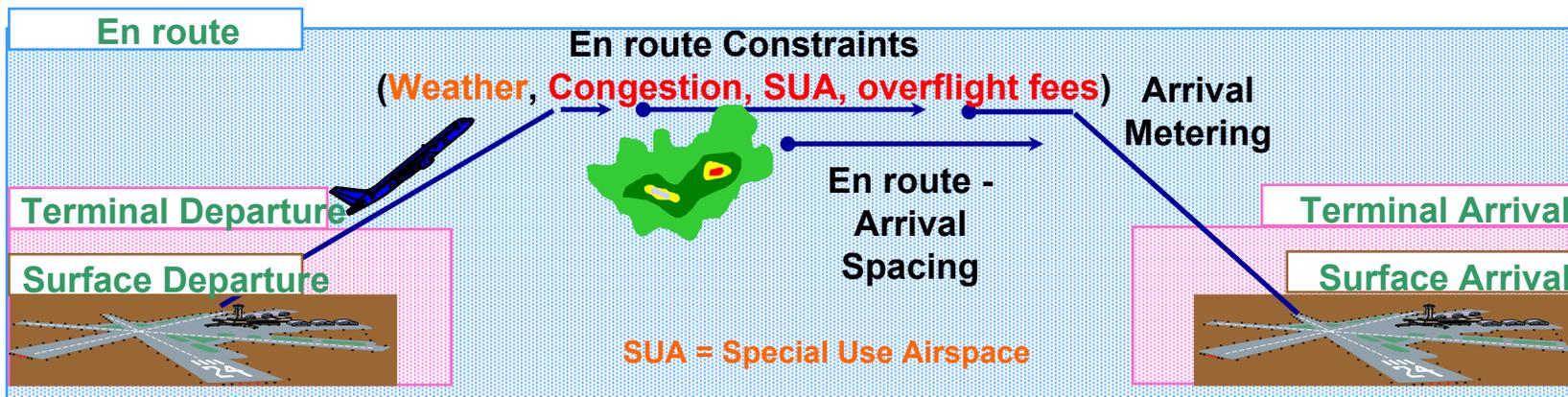


Agenda

- Background
- Accomplishments
- Plans



Airspace Problem

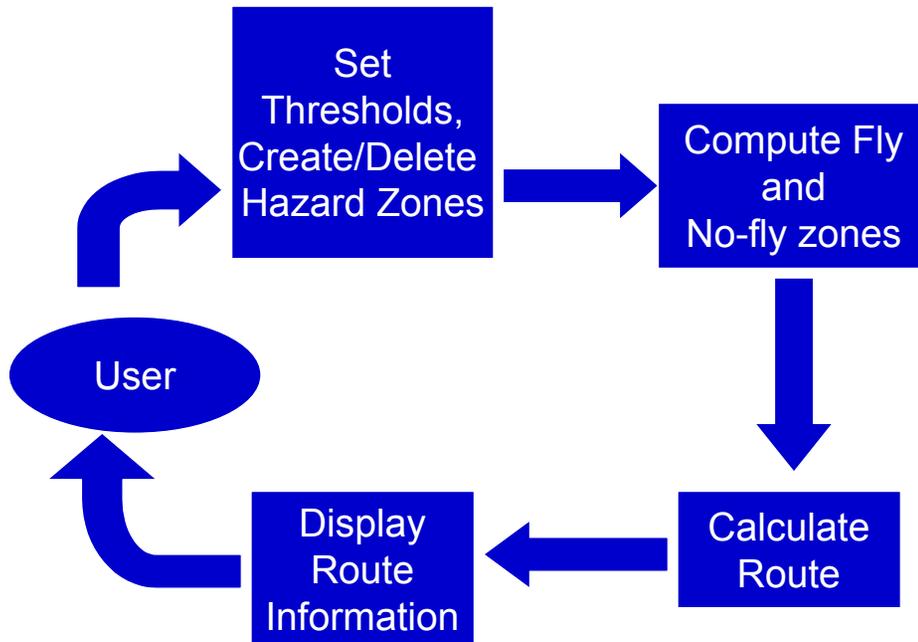


Goals

- Demonstrate improved aviation safety
 - Weather is a factor in 1/3 of commercial carrier accidents
- Improve efficiency
 - Reduce enroute deviations due to weather and other hazards
 - 0.4% fuel savings (NASA CWIN)
 - Less than 3 year payback (Kauffmann Study)
- Lay groundwork for collaborative air-ground decision making



Operational Concept for Decision Aid

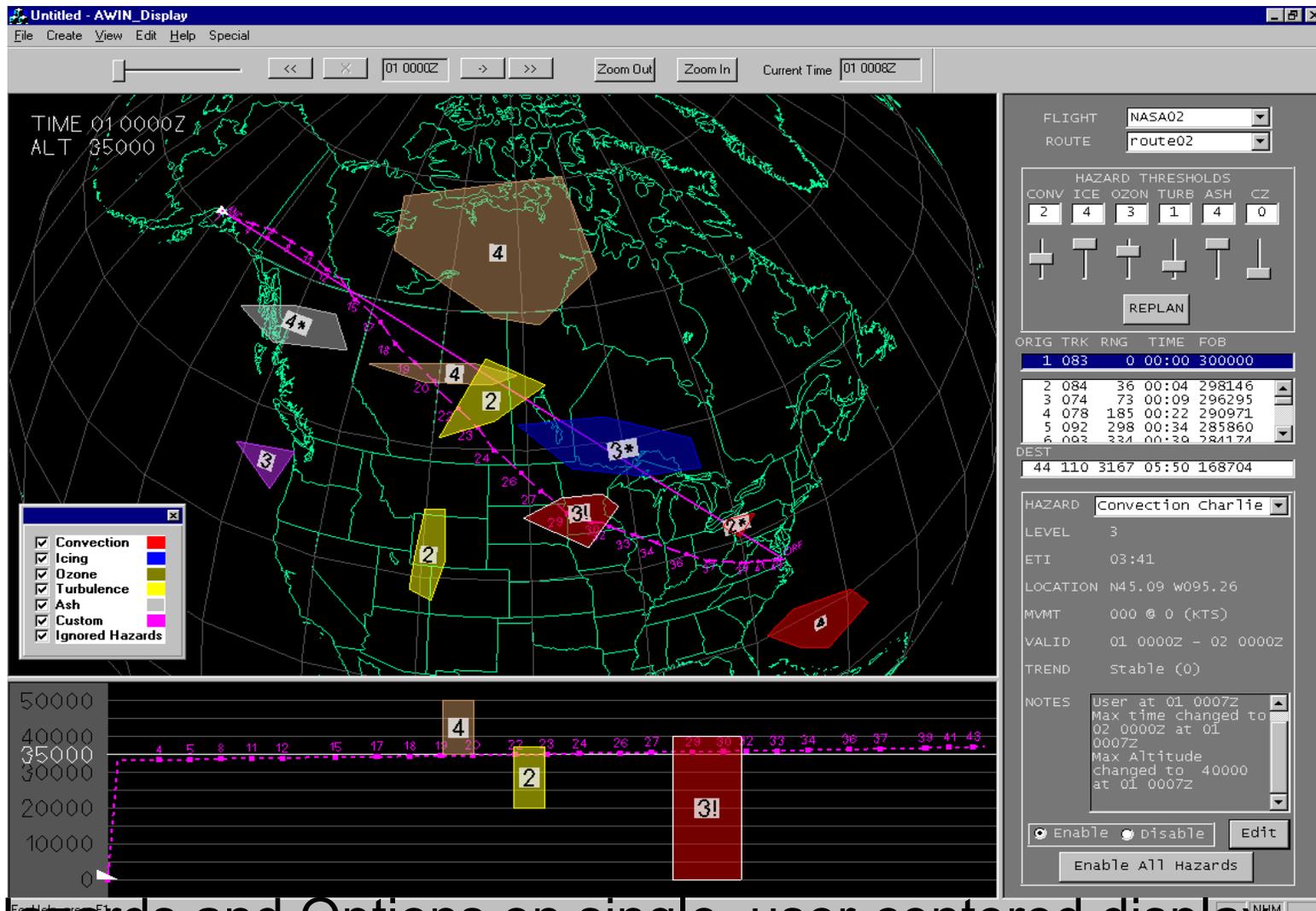


- Strategic planning
- Enroute phase
- User Preferred Trajectories
 - Options beyond SWAP
- Augments a Flight Planner
 - Performs Route Optimization
 - Provides Decision Support

Combine Route Optimization and User Interface Technologies to produce a Decision Support tool



Graphical User Interface



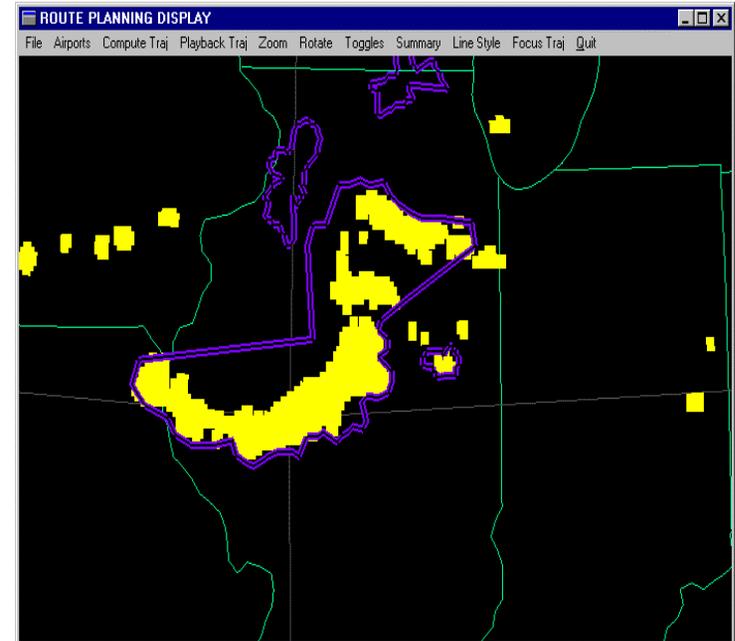
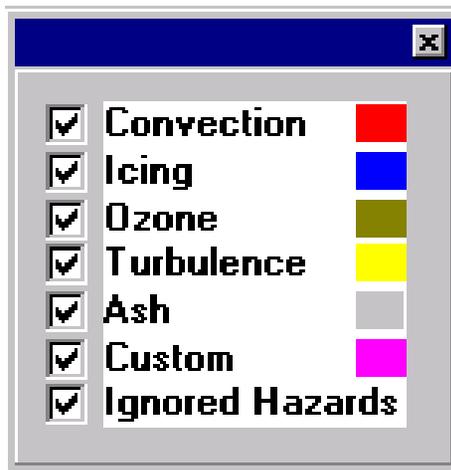
- Hazards and Options on single, user-centered display



Weather Hazard Models

Hazard model

- Polygons
 - Have “tops” and “bottoms”
 - Motion
- Five types used
- Four levels of severity
- Become “no-fly” zones when severity exceeds threshold

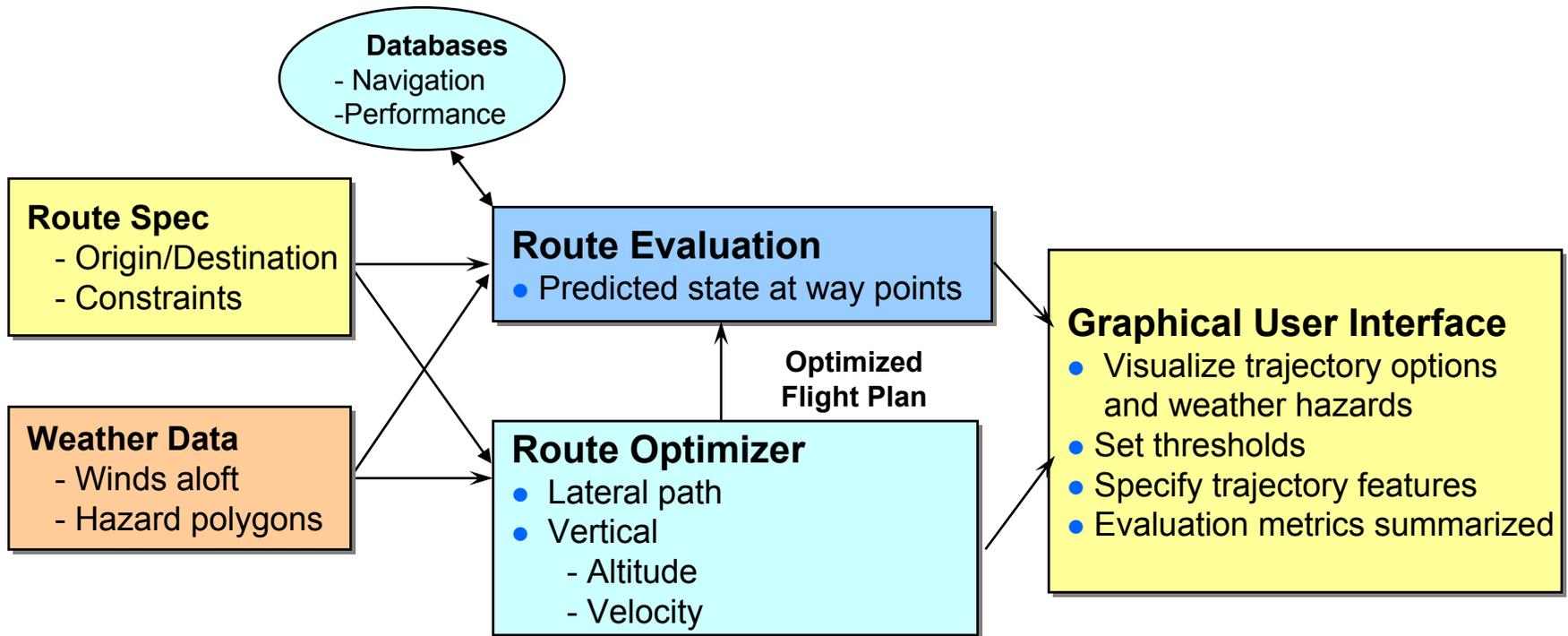


Polygon sources

- New integrated Wx products
 - NCAR Detection Polygons
 - National Convective Wx Forecast
 - Oceanic Convective Nowcasting Demo
- In-house meteorology



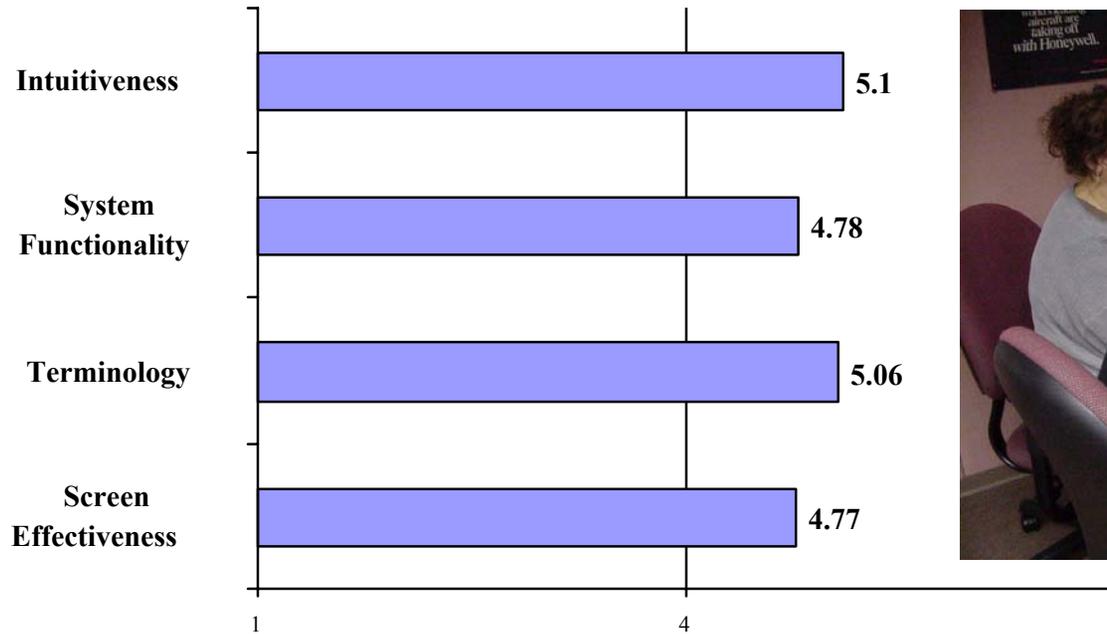
AWIN Flight Planning Aid



Options	Cruise-climb	Fixed Altitude
Long Range Cruise		
Constant Mach		



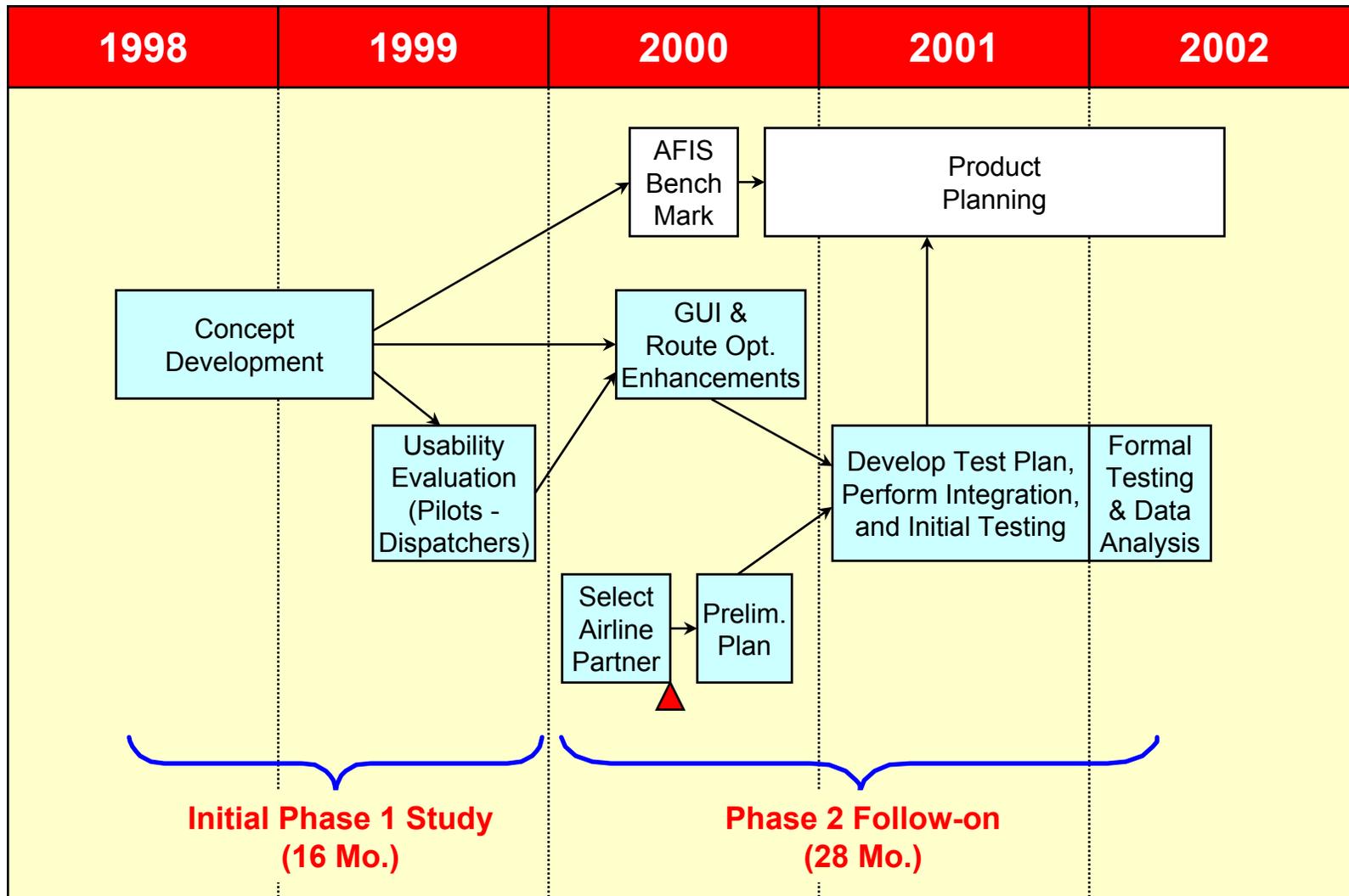
Initial Usability Testing



- Lab tested at HTC during Phase 1
 - Used 12 pilots and dispatchers
 - Series of scripted scenarios
- AWIN tool features were rated very favorably
 - Ratings over 4 considered good for first exposure



Roadmap



AWIN Cooperative Agreement

HI Internal project





Follow-on Plans

Objectives

Evaluate AWIN Decision Aid as a dispatcher's tool

- Perform field evaluation
- Compare performance to existing methods
- Support flight planning and replanning

Approach

Build on results from previous study

- Enhance GUI and Route Optimizer
- Field test with dispatchers



Capabilities of AWIN Flight Planning Aid

User Interface

- Recall/edit stored routes
- Model weather hazards (dialog boxes)
- Adjust hazard severity threshold (determines if hazard avoided)
- Compare metrics of alternate routes
- Display graphically trajectory and hazards
 - Plan view and vertical profile
 - Animation and replay

Route Optimizer Options

- Minimum fuel
- Wind optimal
- Wind optimal and hazard avoidance
- Specify RTA
- Include waypoint constraints
- Potential extensions
 - Traffic avoidance
 - Overflight fee optimization

Benefits

- Rerouting options automatically generated
- Options easily visualized on a single display
- Improved situational awareness and safety



Summary

- Technical Advances
 - Practical algorithm for route optimization/hazard avoidance
 - User Interface introduced new features and received a good usability rating
 - Polygon weather representation is consistent with airline use and NCAR research
 - Polygon color convention under consideration by RTCA SC 195
- Follow-On Plans
 - Integrating weather with flight planning is an important first step on the way to collaborative air-ground decision making
 - AWIN decision aid complements WINN's weather products and airborne display
 - Phase 2 will demonstrate benefits in an operational setting
- Business Issues
 - Partnering with NASA has been effective
 - Current AWIN Decision Aid has product potential
 - Airlines are interested in integrated tools