Important Research Focus Areas:
The View from OSU
Philip J. Smith

- **Issue 1. Integrated management of airport surface and airspace constraints during convective weather**
- **Issue 2. Collaborative routing to support adaptive air traffic flow management**
- **Issue 3. Human factors issues in the design and use of RNAV/RNP routes**
- **Overarching human factors issue:**

  Assuming Old Human Factors Problems are Still Solved When Introducing New Systems

Smith, P.J. (2014). *Yearly Report: Critical Human Factors Issues for Guiding Advances in the Support and Execution of Collaborative Decision Making.* CSEL Technical Report 2014-12, The Ohio State University. Supported by the FAA Human Factors Division (ANG-C1)

Smith, P.J., Murphy, M., Stellings, E. and the CDM Flow Evaluation Team (2014). *Operating in a CTOP (Collaborative Trajectory Options Program) Environment.* CSEL Technical Report 2014-10, The Ohio State University. Supported by the FAA Collaborative Decision Making Program and the FAA Human Factors Division (ANG-C1)

Smith, P.J., Durham, K. and Evans, M. (2014). *Best Practices and Lessons Learned in the Development and Use of RNAV Routes.* CSEL Technical Report 2014-16, CSEL, The Ohio State University. Supported by the FAA Human Factors Division (ANG-C1).

Issue 1. Integrated Management of Airport Surface and Airspace Constraints During Convective Weather

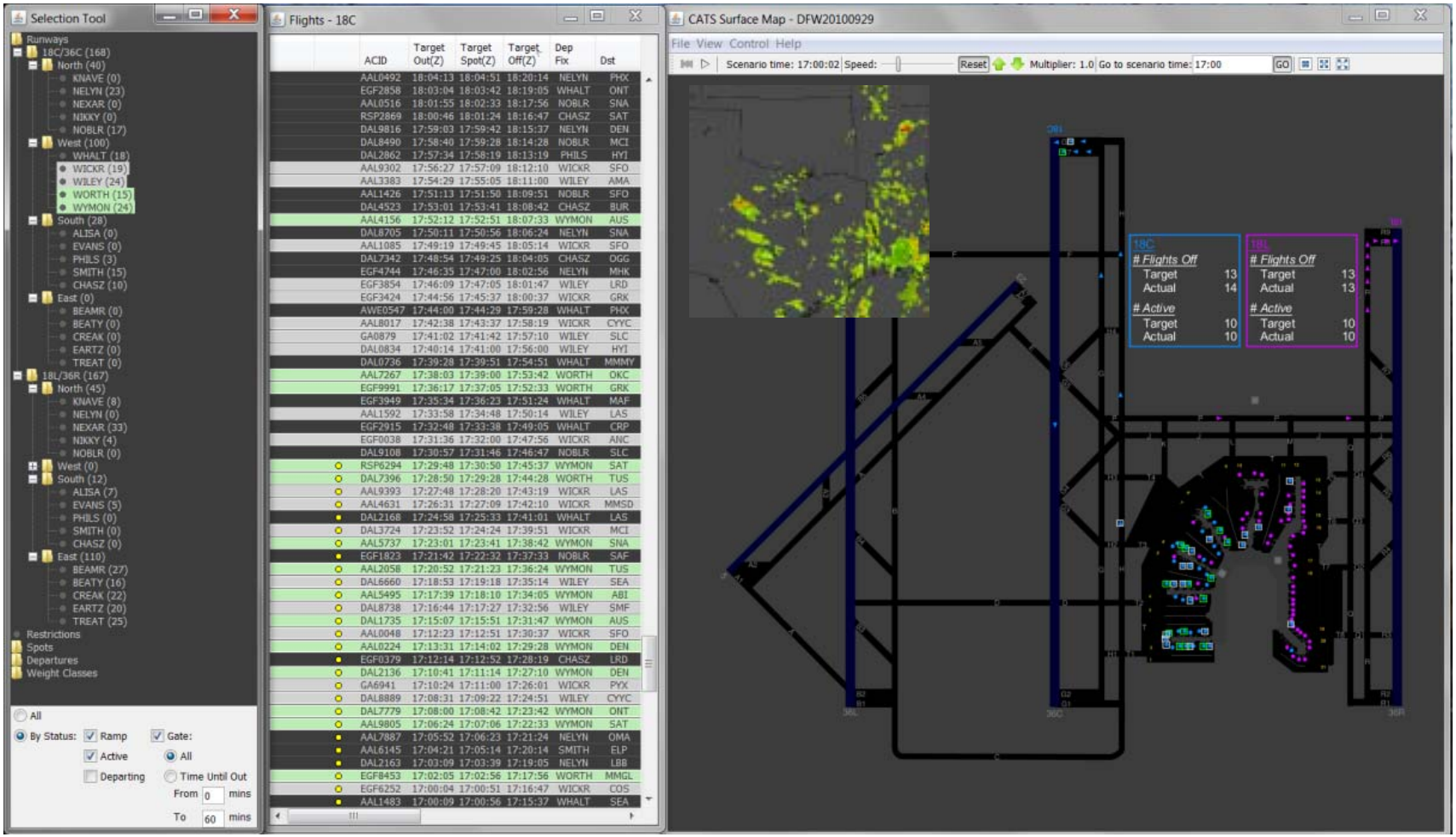


Figure 12. Flights filed to depart via WICKR and WILEY highlighted in gray; flights filed to depart via WORTH and WILEY highlighted in green.

Issue 2. Collaborative Routing:
New Strategies and Tools for Adaptive Air Traffic Flow Management

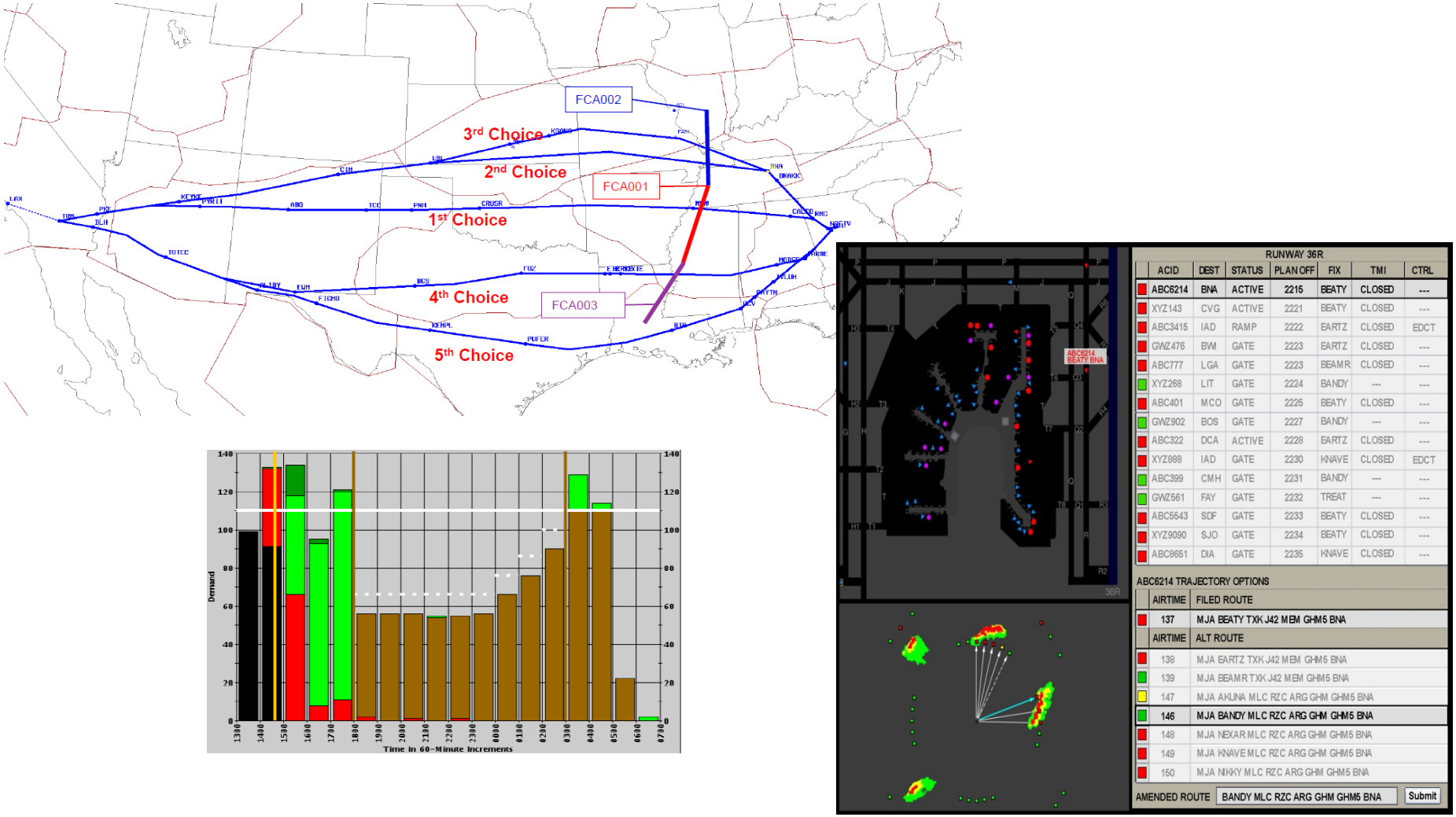


Figure 21. Integration of airspace, airport surface information to support manual reroutes using the information in a TOS

Overarching Human Factors Issue:
Assuming Old Human Factors Problems are Still Solved When Introducing New Systems
(Example: Issue 3. Human factors issues in the design and use of RNAV/RNP routes)

Human-Automation Interaction:
Predicted Accident in the Use of an RNAV Approach –
Overtake on Approach & Missed Approach Conflict (Smith, Rinehart and Spencer)

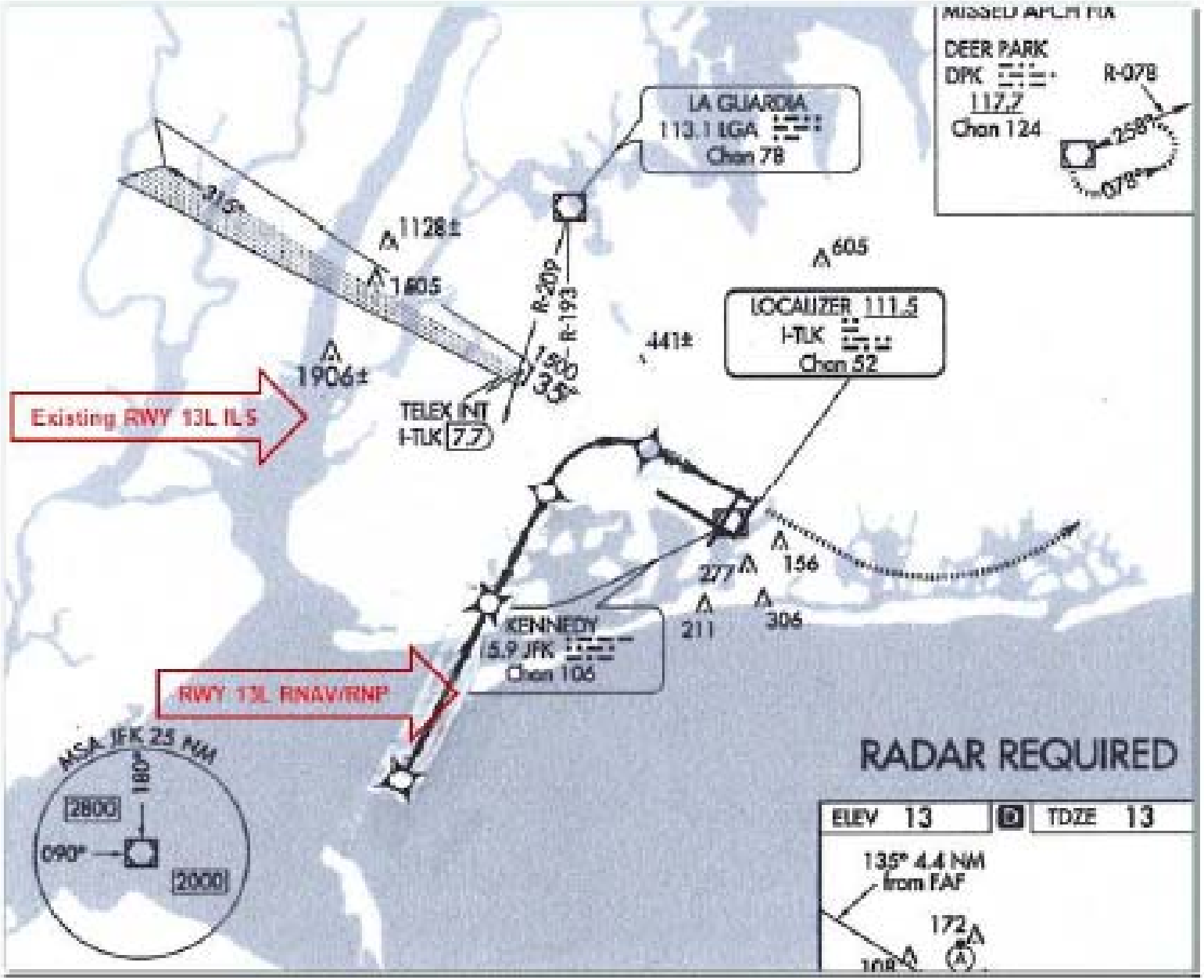
Perspective	What happens or doesn't happen?	What actions are taken or not taken?
Flight Crew	During preparation for takeoff from SVO to JFK, Delta 467 flight crew notes that predicted weather in JFK is calling for excellent visibility and winds from the southeast.	Pilot Flying (PF) is the First Officer. PF loads Parch 1 RNAV arrival and VOR RWY 13L Approach.
Flight Crew	After completing ocean crossing and approaching Top of Descent, Pilot Monitoring (PM) gets updated ATIS via ACARS. ATIS "D" shows VOR RW 13L. Clear skies. Winds 140 at 15 knots. Departing RW13R.	PF transfers control to PM and briefs for a RNAV Visual for RW 13L at JFK. He notes that RNAV Visual must be requested but is normally given when weather is good and that the LNAV and VNAV Guidance works well. As part of the brief he notes that there is no missed approach published as it is a Visual Approach procedure.

Perspective	What happens or doesn't happen?	What actions are taken or not taken?
Flight Crew	New York Center controller clears Delta 467 on Parch arrival to cross TRAIT at FL240.	PF begins descent using VNAV to cross TRAIT at FL240. CCC is programmed for 250/12000 and ROBER at 9000 but altitude window is set for 24000.
Flight Crew	New York Center controller clears Delta 467 to cross CCC at 12000 feet and 250 knots.	PF sets 12000 into altitude window and selects VNAV to continue descent on PARCH arrival profile.
Flight Crew	Approaching CCC, New York Center switches Delta 467 to New York Approach.	PM checks in with NY Approach with ATIS "D". NY Approach states that Delta 467 should expect VOR RW 13L and continue descent to 9000. PM asks for RNAV Visual RW 13L. Controller states that Delta 467 should expect that.
Flight Crew	Approaching ROBER, NY Approach begins giving vectors to Delta 467 with an initial vector of 180 with a descent to 5000'.	PF sets 5000' in altitude window and selects FLCH. PF sets heading 180 in heading window and presses to select Heading Select. He instructs PM to "extend the centerline". PM selects ASALT as the active Waypoint and sets the course to 045 and executes to select an extended line for the approach for 13L.

Perspective	What happens or doesn't happen?	What actions are taken or not taken?
Flight Crew	Controller switches Delta 467 to final controller.	PM checks in with NY Approach "at 5500' descending to 5000'". Check in is acknowledged and a continued descent to 3000' is directed with a vector of 230. Crew is told to expect RNAV Visual RW13L. PF resets altitude window and heading window.
Flight Crew	At approximately 8 miles abeam ASALT, a vector of 280 is given. Speed of 180 knots.	PM acknowledges. PF selects heading of 280, and speed of 180 knots. Flaps are extended to 5 degrees on schedule.
Flight Crew	At approximately 6 miles from ASALT, a vector of 360 is given.	PM acknowledges. PF selects heading of 360 degrees.

Perspective	What happens or doesn't happen?	What actions are taken or not taken?
Flight Crew	At approximately 4 miles from ASALT a vector of 020 is assigned and Delta 467 is cleared for the RNAV Visual RW13L with a switch to tower frequency.	PM acknowledges. PF sets heading to 020 degrees, and calls for flaps to 15. He arms LNAV. Sets altitude window to 100 feet. Arms VNAV and sets speed intervention for 180 knots again. PM checks in with tower. Tower states that Delta 467 is cleared to land following a Regional Jet 4 miles ahead.
Flight Crew	Aircraft crosses ZADUD at 3000' at 180 knots and shortly begins a descent on autopilot.	Flight crew notes that they are on profile.
Flight Crew	Passing 1800'	PF calls for gear down and sets speed window for final approach speed of 147 knots. After gear is down he calls for flaps 25 and landing checklist.
Tower	On radar tower notes a closure rate of 50 knots between Delta 467 and the RJ they are following.	Tower Controller directs Delta 467 to slow to final approach speed and states that they are overtaking the RJ they are following by 50 knots.

Flight Crew	Both pilots begin scanning for RJ. Aircraft is between WIRKO and JEVNI passing 1000' and in a right turn.	They see the RJ ahead and note on their TCAS that they are less than 3 miles behind the RJ.
Flight Crew	Tower controller believes an unsafe situation is developing and directs "Delta 467 cancel landing clearance, go around".	PF hits go around buttons on back of throttle, states "go around, flaps 20". Aircraft rolls wings level heading approximately 090 degrees. Power comes up and aircraft begins climb. PM selects flaps to 20, sees the climb begin and states, "positive rate". PF calls for "gear up". PM selects gear to up position.
Flight Crew	Aircraft is climbing through 1200' in a heading hold mode.	Since nothing has been selected for a roll mode, from an RNAV approach, aircraft reverts to heading hold on the last heading it was passing through.
Tower	Tower controller realizes a police helicopter is just north of the airport at 1500'. The aircraft will not have sufficient separation. He commands Delta 467 to take heading 150.	PF selects heading select of 150. Aircraft begins a right turn.
Flight Crew	TCAS gives "traffic" warning and commands a descent.	To be continued.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ELEV 13
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Overarching Human Factors Issue:
Assuming Old Human Factors Problems are Still Solved When Introducing New Systems

How do we detect such assumptions?

How do we ensure that such assumptions are dealt with during the design so that either:

- The problem is eliminated so that the critical scenarios cannot arise?
- There are sufficient safety nets so that, if a critical scenario arises, the system is sufficiently resilient to deal with it?

Overarching Human Factors Issue:
Assuming Old Problems are Still Solved When Introducing New Systems
(Example: Issue 2. Collaborative routing to support adaptive air traffic flow management)

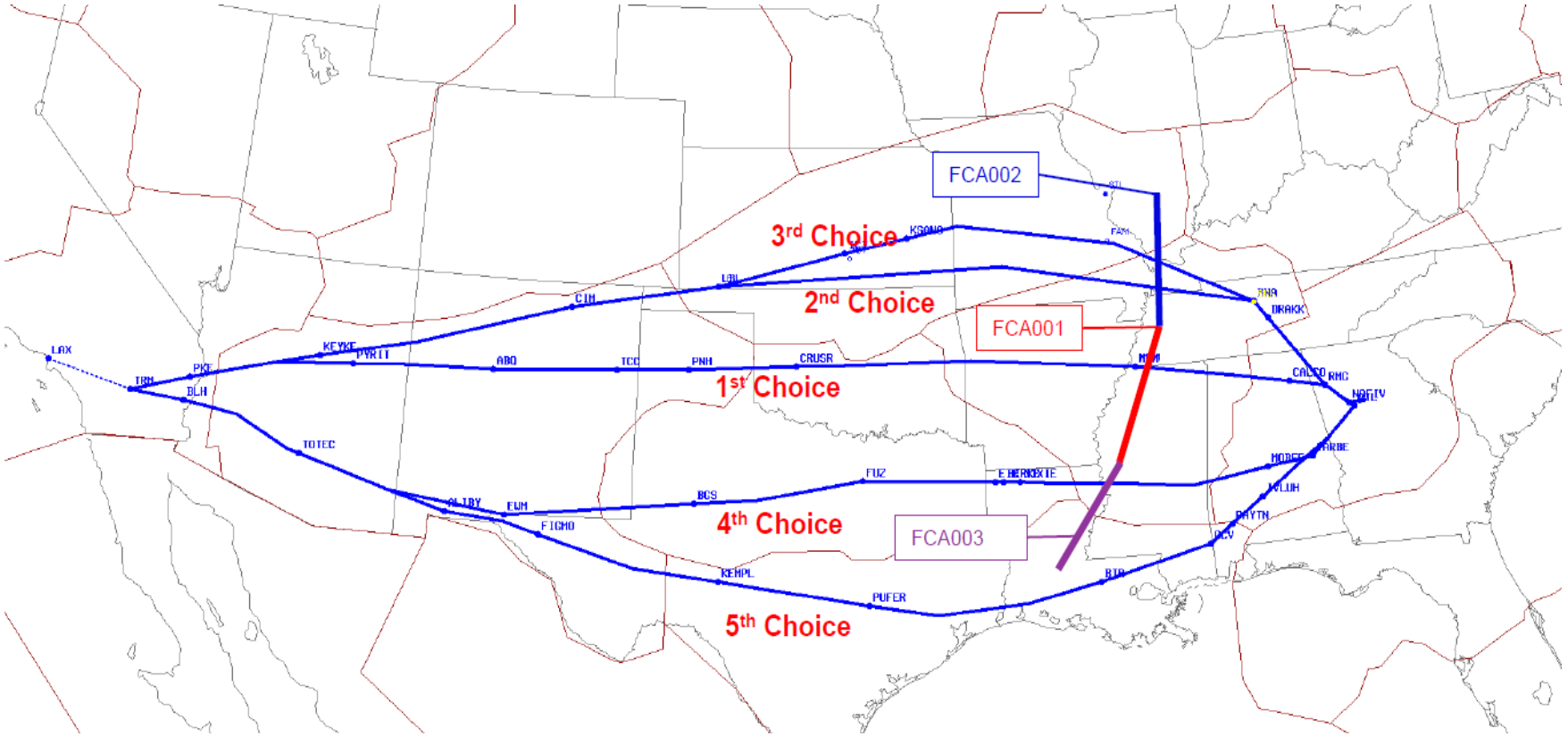
Design of Distributed Work System
Predicted Accident due to predictable performance by software designers, dispatchers, traffic managers and controllers

CTOP (Collaborative Trajectory Options Program)

Historical problem (2001): Dispatcher filing CDRs with "unusual" turns

Example: CDR EWRBNA36 (KEWR COATE Q436 HERBA JHW J29 DJB J29 ROD FLM HYK DREFT PASLY2 KBNA)

CTOP Review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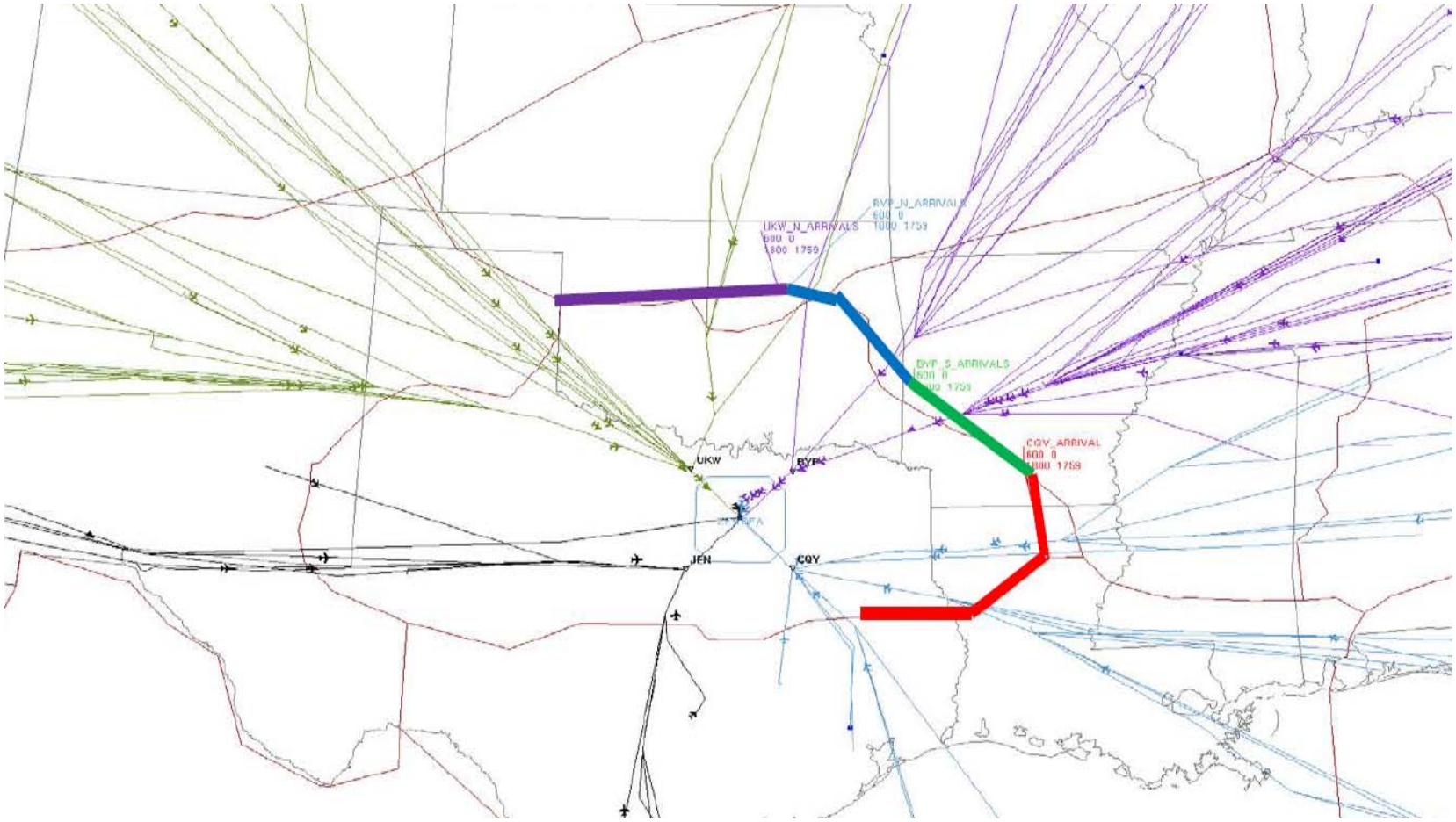
CTOP Review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Historical safety nets to this unanticipated issue (2001): Departure Center TMU (weak solution); Display of route on strip (weak solution); Controller detecting unexpected trajectory; Pilots; TCAS

Historical solution (2002): Procedures, training and airline automation (in response to actual occurrences)

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New issue (2014): Flight operator software submitting TOS including "unusual" CDR; FAA software selecting this route

Safety nets(?):

- Automation Developers
  - Flight operators
  - FAA
- Dispatcher
- Departure center traffic manager (weak solution)
- Display of route on strip (weak solution)
- Controller detecting unexpected trajectory
- Pilots detecting potential loss of separation
- TCAS detecting potential loss of separation

Solution(?)

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