

Decision Support Systems (DSS)

TOS of Tomorrow



CDM
Collaborative
Decision Making



Federal Aviation
Administration



Life Cycle of a TOS



TOS Scenario with

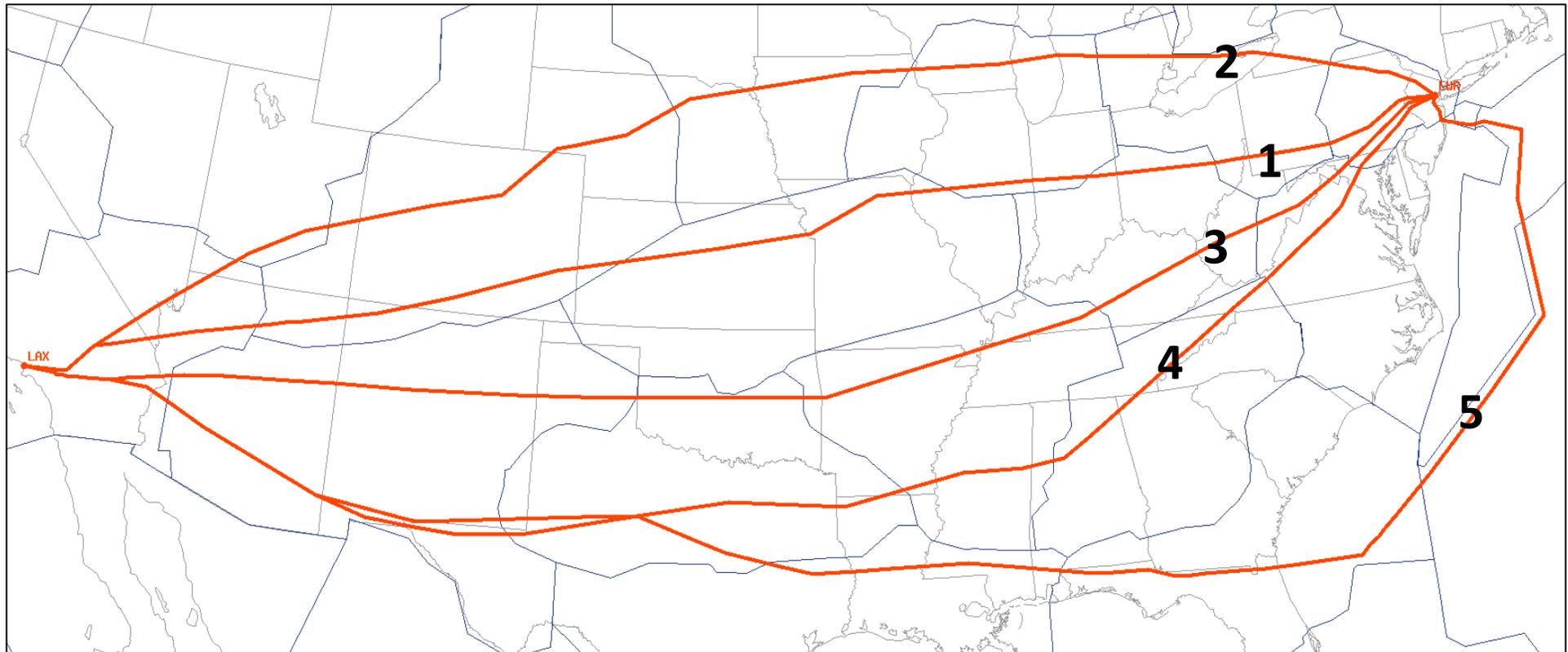
- Fully developed, mature operator software
- TFMS software as currently deployed
- TFMS future tools leverage current design

Status of Flight Plan	Scheduled only	Filed with ERAM	Airborne Constraint #1	Airborne Constraint #2
Type of TOS	Full set of Options	Options that fit with closer time frame	Options that conform with fuel load	Options that conform with fuel load

Phase 1 – Scheduled Flight TOS – EWR to LAX



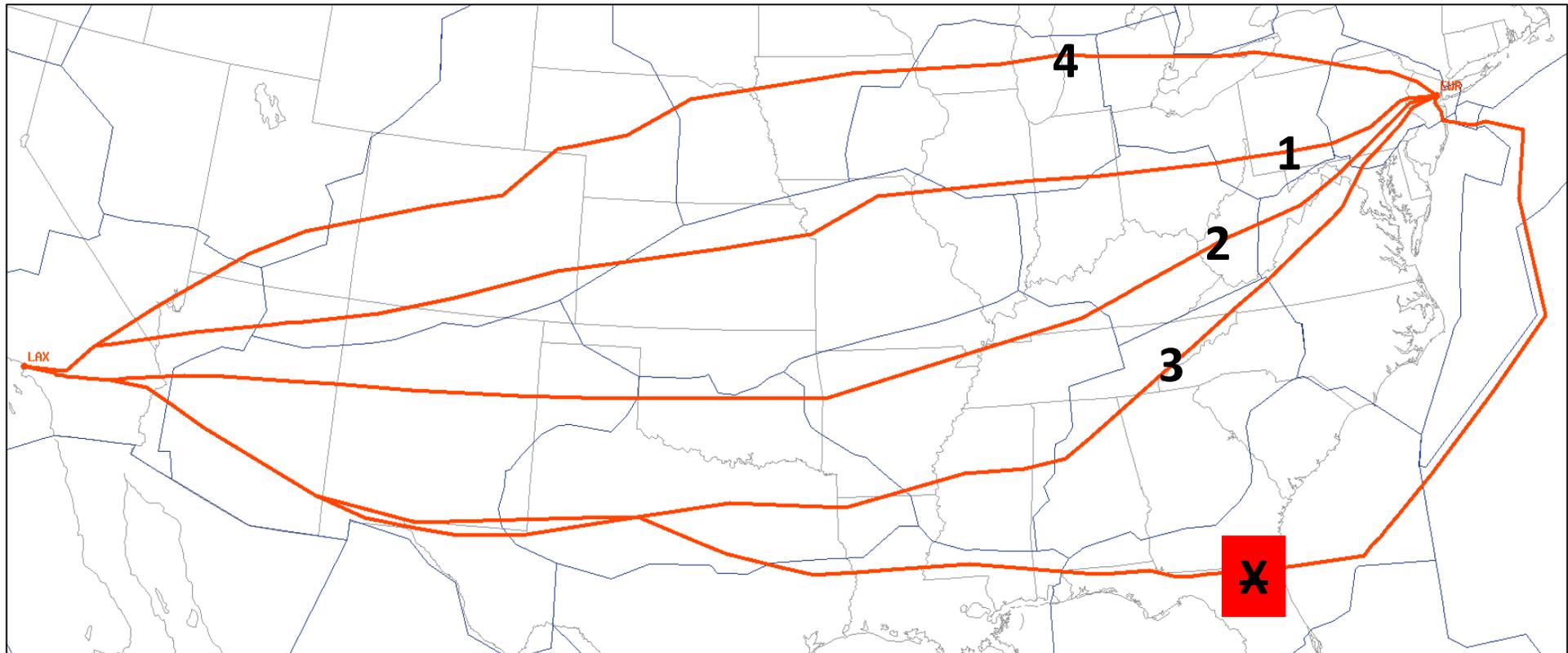
TOS Line	Dep Gate / Route	Operational Reason
1	ZIMMZ IRK MCI	Closest to Great Circle Route
2	COATE BAE ONL	Southerly Jet
3	PARKE FSM PNH	Northerly Jet
4	LANNA EIC ABI	Avoid Convection in ZKC
5	ELVAE TAY CEW	Last Resort - Only gate not blocked



Phase 2 – Filed Flight Plan, Northern Jet with Northern Rockies Mountain Wave



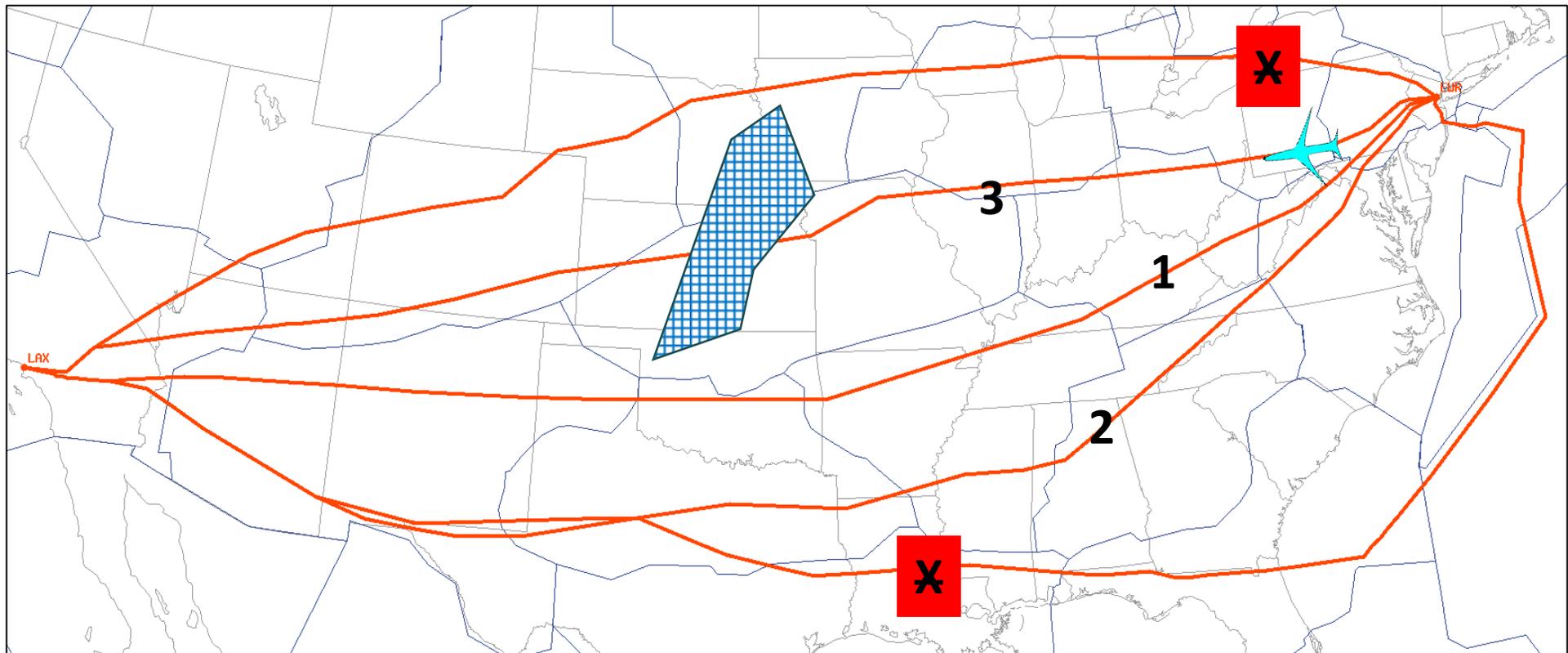
TOS Preference	Dep Gate / Route	Operational Reason
1	ZIMMZ IRK MCI	Shortest while avoiding Mountain Wave
2	PARKE FSM PNH	Next lowest fuel burn
3	LANNA EIC ABI	No convection yet in ZKC
4	COATE BAE ONL	Least preferred due to Jet/Mountain Wave
5	ELVAE TAY CEW	Last Resort – Only gate not blocked



Phase 3 – Flight now Airborne, Convection has developed across ZKC



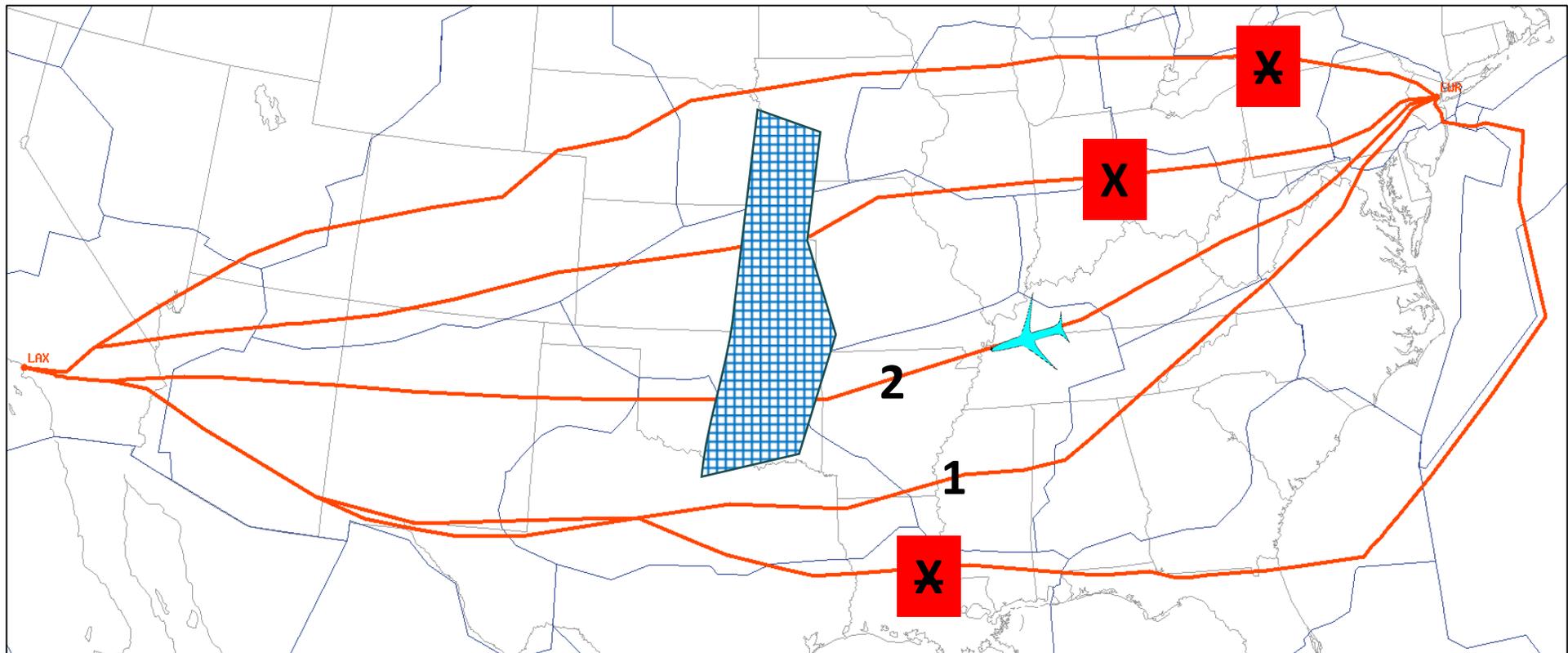
TOS Preference	Dep Gate / Route	Operational Reason
1	PARKE FSM PNH	Lowest fuel burn and avoids the TSTMS
2	LANNA EIC ABI	Avoids TSTMS but longer route
3	ZIMMZ IRK MCI	Most impacted by TSTMS
X	COATE BAE ONL	Least preferred due to Jet/Mtn Wave
X	ELVAE TAY CEW	Last Resort – Only gate not blocked



Phase 4 – Flight Airborne, Convection has spread into ZFW



TOS Preference	Dep Gate / Route	Operational Reason
1	LANNA EIC ABI	Avoids TSTMS
2	PARKE FSM PNH	Does not avoid TSTMS
X	ZIMMZ IRK MCI	No longer an option
X	COATE BAE ONL	No longer an option
X	ELVAE TAY CEW	No longer an option



Life Cycle of a TOS – TFMS Tools



Status of Flight Plan	Scheduled only	Filed with ERAM	Airborne Constraint #1	Airborne Constraint #2
Type of TOS	Full set of Options	Options that fit with closer time frame	Options that conform with fuel load	Options that conform with fuel load
TFMS Tools	CTOP	CTOP PDRR Departure Viewer	ABRR Future Tools	ABRR Future Tools



ABRR and PDRR use the Route Amendment Dialog (RAD)

Select the flight to be rerouted

Retrieve routes or create new route

Flight	P-Time	Route Code	Sector	TMI ID	RRSTAT
<input checked="" type="checkbox"/> UAL1861	1700	R		TRDCCO	

Merge/Optimize if needed

Send to ERAM

TOS visibility in the RAD



Route Amendment

Retrieve Routes: Recently Sent..., Search DB..., Route Code: [], Get CDR, Add Route, Remove Flights...

Flight/Route Color: Show Protected Segments

Show Merge ID

Current Routes

<input checked="" type="checkbox"/>	<input type="checkbox"/>	UAL1861	R	KEWR..ZIMMZ.Q42.STRUK..KK60I..AGENT.J96.SLN..ALS..TBC.J64.PGS.RIIVR2.KLAX	---	Rte Opts...
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CDR
 CDR
 MANUAL

UAL1861 Route Options

TMI Route Options: No TMI Route Options are available. Reroute

TOS Options

<input checked="" type="checkbox"/>	<input type="checkbox"/>	KEWR..ZIMMZ.Q42.STRUK..KK60I..AGENT.J96.SLN..ALS..TBC.J64.PGS.RIIVR2.KLAX
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Add to Retrieved Routes Add to Amendment Cancel Help

Create Route Amendment: Merge Use Last Sent Optimize Route(s)

		P-Time		Sector	TMI ID	RRSTAT
<input checked="" type="checkbox"/>	<input type="checkbox"/>	ALL				
<input checked="" type="checkbox"/>	<input type="checkbox"/>	UAL1861	1700	R	TRDCCO	

Preview Undo Amendments will be sent for 0 flights

Send Cancel Help

Rte Opts: Displays all of the options in the current TOS if one exists.

UAL1861 Route Options

TMI Route Options: No TMI Route Options are available. Reroute

TOS Options

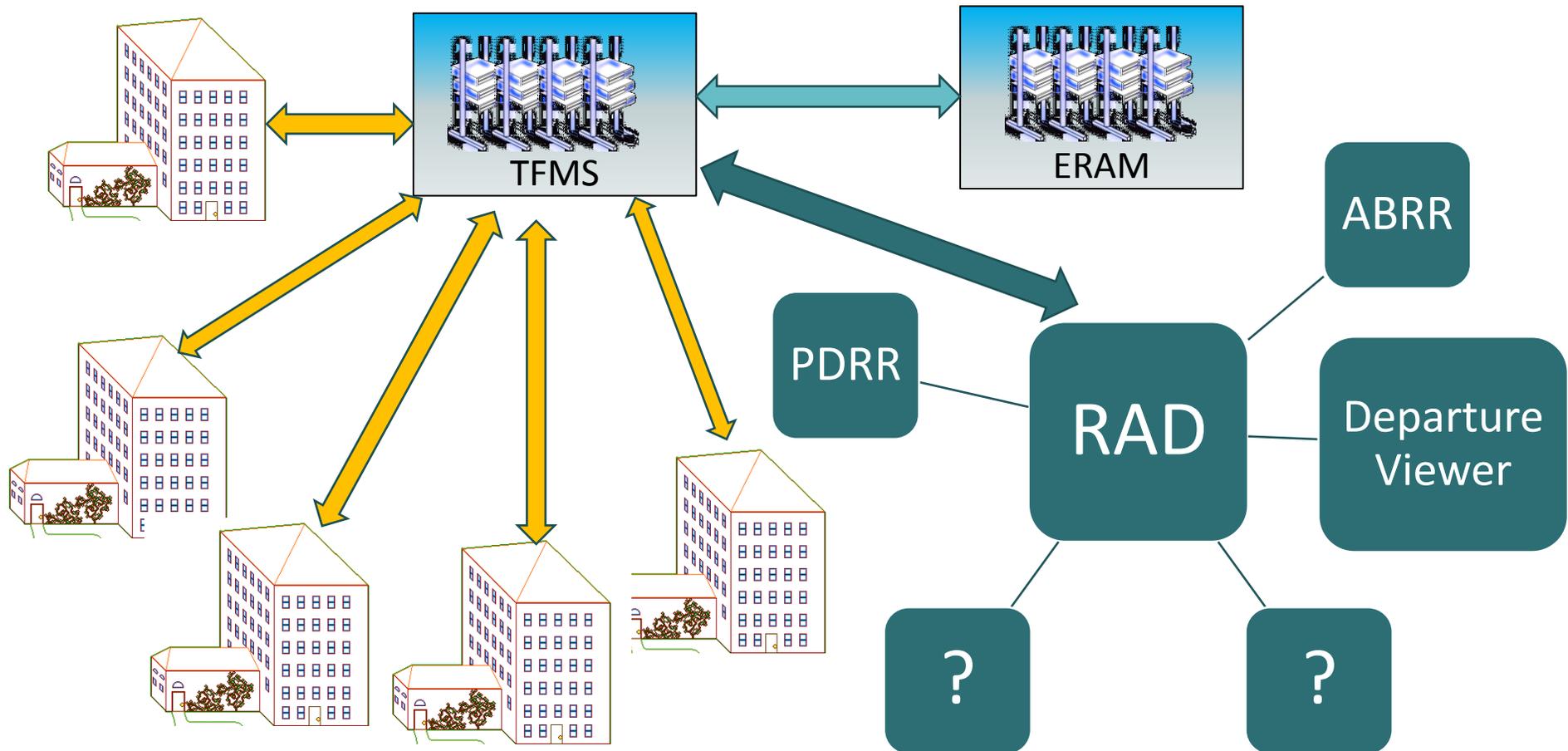
<input checked="" type="checkbox"/>	<input type="checkbox"/>	KEWR..ZIMMZ.Q42.STRUK..KK60I..AGENT.J96.SLN..ALS..TBC.J64.PGS.RIIVR2.KLAX
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Add to Retrieved Routes Add to Amendment Cancel Help

Operator route preference will be available to the TMC



- Foundation for TOS integration has been established with the RAD
- Future tools will leverage and enhance the use of TOS
- Since a TOS can be updated once a minute, the operators can continue to express their preferences and provide their input throughout all phases of flight





Current Status of TOS Submissions

April 5, 2016 TOSs submitted to Operations (no TAPS)

- ❖ 4,275 TOSs submitted (from 2 operators)
- ❖ 3,676 TOSs accepted – 86%
- ❖ 599 TOSs Rejected – 14%
 - 39 rejections due to flight cancelled or completed (1%)
 - 27 rejections for TOS sequence out of order (1%)
 - 533 rejections for route problems (12%)
 - ✓ 244 **from** Foreign Origin Airports(6%)
 - ✓ 190 **to** Foreign Destination Airports (4%)
 - ✓ 99 Domestic TOSs rejected for route problems(2%)



Acronyms

Acronym	Description
ABRR	Airborne Rerouting
CDM	Collaborative Decision Making
CDR	Coded Departure Route
CTOP	Collaborative Trajectory Options Program
DSS	Decision Support Systems
ERAM	En Route Automation Modernization
EWR	Newark Liberty International Airport
LAX	Los Angeles World Airport
PDRR	Pre-Departure Reroute
RAD	Route Amendment Dialog
TMI	Traffic Management Initiative
TOS	Trajectory Option Set
TFMS	Traffic Flow Management System
TSTMS	Thunderstorms
ZFW	Forth Worth Center
ZKC	Kansas City Center