

**APPLICATIONS GUIDE**  
**for**  
**Flow Constrained Areas (FCAs) /**  
**Flow Evaluation Areas (FEAs)**

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**APPLICATIONS GUIDE**  
**For**  
**Flow Constrained Areas/Flow Evaluation Areas**

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## Section 1 — Introduction

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### 1.1 Purpose

The main purpose of the Flow Evaluation Area (FEA)/Flow Constrained Area (FCA) Applications Guide is to share some examples of ways various System Stakeholders (both FAA and Customers) utilize the FEA/FCA tools and procedures to help monitor and/or identify possible airspace constraints. The sharing of this information can be beneficial to all. In the manual, you may see some examples that you find useful at your facility or Flight Operations Center (FOC). As more System Stakeholders become familiar with the many ways the FEA/FCA tools and procedures can be used, the potential exists that new ways will be identified to utilize these tools to increase the efficiency of the National Airspace System (NAS).

Another goal of this guide is to help develop a more consistent and standardized approach by the System Stakeholders on the use of the FEA/FCA tools and procedures. With expanded and consistent usage, the FEA/FCA tool and procedures will continue to produce significant benefits. If you see an opportunity to use the FEA/FCA procedures to help monitor or control either a real or potential constraint, we ask that you share your ideas on the operational Planning Telcon. Or, if unable due to timing, discuss ideas with the Air Traffic Control Systems Command Center (ATCSCC). If it is determined that a particular constraint may affect the NAS, that constraint information should be shared with other System Stakeholders (NAS Customers or FAA Facilities) so appropriate action may be taken.

Through the use of the FEA/FCA, we can optimize the use of the NAS and increase its efficiency. We thank you for taking the time to review this guide. The FCA/Reroute Workgroup welcomes suggestions or ideas that would help expand the use of these tools and procedures, and the ATCSCC stands ready to assist you with any questions you might have regarding the use of FEAs/FCAs.

### 1.2 Scope

This FEA/FCA Applications Guide document is intended for use by both traffic management personnel and flight operation center personnel.

This Applications Guide offers a sampling of practical ideas for the use of FEAs and FCAs; both the most common uses and also some more unique or creative FEA tactics in use at some facilities or dispatch offices. It then provides summary information regarding written procedures, training material, and other references.

This Guide is intended to share examples of usage in order to promote increased use and creative ideas. It is not intended to be a comprehensive users guide with detailed 'how to' information.

The information in this document will be condensed into a ‘quick reference guide’ for easy and practical access by ATC/traffic managers and flight dispatchers working in the field.

### 1.3 Background

#### About FEAs/FCAs:

The Traffic Situation Display (TSD) and the Common Constraint Situation Display (CCSD) provide Air Traffic Control (ATC)/traffic managers and flight dispatchers with the ability to define and display FEAs and/or FCAs<sup>1</sup>. An FEA/FCA is a user-defined volume of airspace along with associated flight lists and filters. FEAs and FCAs are used to show areas where the traffic flow should be evaluated or where initiatives should be taken due to severe weather or volume constraints.

ATC/traffic managers or flight dispatchers define a geographic area of an FEA or an FCA by drawing a polygon or a line on the display and defining the ceiling and floor of the FEA/FCA using a dialog box. Alternatively, an FEA/FCA tool user can designate a NAS element as an FEA/FCA (e.g., a fix, an airport, a sector, or a TRACON). The tool user also defines criteria for filtering the flights that are predicted to intersect the drawn FEA/FCA (e.g., by airports, by Center traversed, or by departure or arrival points). The FEA/FCA tool user also defines a time period for the FEA/FCA (maximum of 23 hours).

It is useful here to distinguish FEAs from FCAs. A *Flow Evaluation Area (FEA)* is a two-dimensional line or three-dimensional volume of airspace, along with filters and time boundaries, used to identify flights associated with a potential (or actual) constraint. FEAs can be built by Traffic Management Coordinators (TMCs) at Traffic Management Units (TMUs), Traffic Management Specialists (TMSs) at the Air Traffic Control System Command Center (ATCSCC), or by flight dispatchers at various flight operations centers (using CCSD).

A *Flow Constrained Area (FCA)* is a two-dimensional line or three-dimensional volume of airspace, along with filters and time boundaries, used to identify flights subject to an actual constraint. FCAs are built by the ATCSCC and require a traffic management initiative (TMI); for example, a reroute.

Any FEA tool user can create ‘*Private*’ FEAs for viewing on their workstation to monitor traffic flows and evolving traffic flow situations. FEAs and FCAs may also be ‘*Shared*’ with other ETMS users to pass information between various facilities. FEAs can also be shared with NAS customers via the CCSD.

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<sup>1</sup> ETMS displays data to ATC/traffic management personnel through the TSD with graphics drawn on the map, text reports, and alert and FEA/FCA timelines and bar charts. The CCSD is a web-based product used by FOC personnel to view the same traffic demand and constraint information as the ATC/traffic managers see.

Domains and Action Types:

A *domain* refers to one of three FEA types – Private, Shared, or Public. Only tool users at the ATCSCC can create ‘Public’ FEAs or FCAs. All tool users can create ‘Shared’ and ‘Private’ FEAs.

Domains types can be summarized as follows:

<b>DOMAIN</b>	<b>REASONS</b>	<b>RESULTS EXPECTED</b>
PRIVATE FEA	Monitor internal capacity, sector load, potential congestions situations	<ul style="list-style-type: none"> <li>• No impact to NAS Customers’ routes of flight</li> <li>• Achieve improved internal awareness for better decision making</li> </ul>
SHARED FEA	Advise of potential impact to others	<ul style="list-style-type: none"> <li>• Bigger picture awareness for all</li> <li>• Collaboration between stakeholders</li> </ul>
PUBLIC FEA (ATCSCC only)	There is likely to be impact to the Customers’ routes of flight	<ul style="list-style-type: none"> <li>• Possible Customer assistance to avoid TMIs</li> <li>• FAA evaluation of user actions</li> </ul>
FCA (ATCSCC only)	A Traffic Management Initiative (TMI) is needed	<ul style="list-style-type: none"> <li>• Required Customer action</li> </ul>

FAA Advisories (ADVZYs) contain one of four Action types as described below:

<b>ACTION</b>	<b>DEFINITION</b>
FYI	Information contained in a FEA-associated ADVZY is purely informational in nature – no action required.
PLN	Information contained in a FEA-associated ADVZY is for planning purposes; intended to keep all stakeholders aware of a possible situation so they may begin planning alternate actions.
RMD	The Route or other specified action contained in a FEA-associated ADVZY is recommended in order to avoid problems or the likelihood of more severe restrictions.
RQD	Route contained in an FCA-associated ADVZY is required to fly in the NAS.

Using FEAs/FCAs:

FEAs are commonly used to help National Airspace System (NAS) stakeholders maintain common situational awareness. Hence, ‘sharing’ is encouraged whenever possible so that all affected parties are aware of possible events or actions, and when possible, all stakeholders can share in solving problems before they become major system constraints. This theme will be revisited in the examples provided in Section 2.

When time allows, ATC/traffic managers will progress from ‘private’ FEA evaluation to ‘shared’ FEA option explorations to a ‘public’ FEA or FCA that may have required actions associated. The Functional Flow Diagram below (Figure 1-1) depicts this “ideal” flow of evaluation, option generation and finally, TMI.

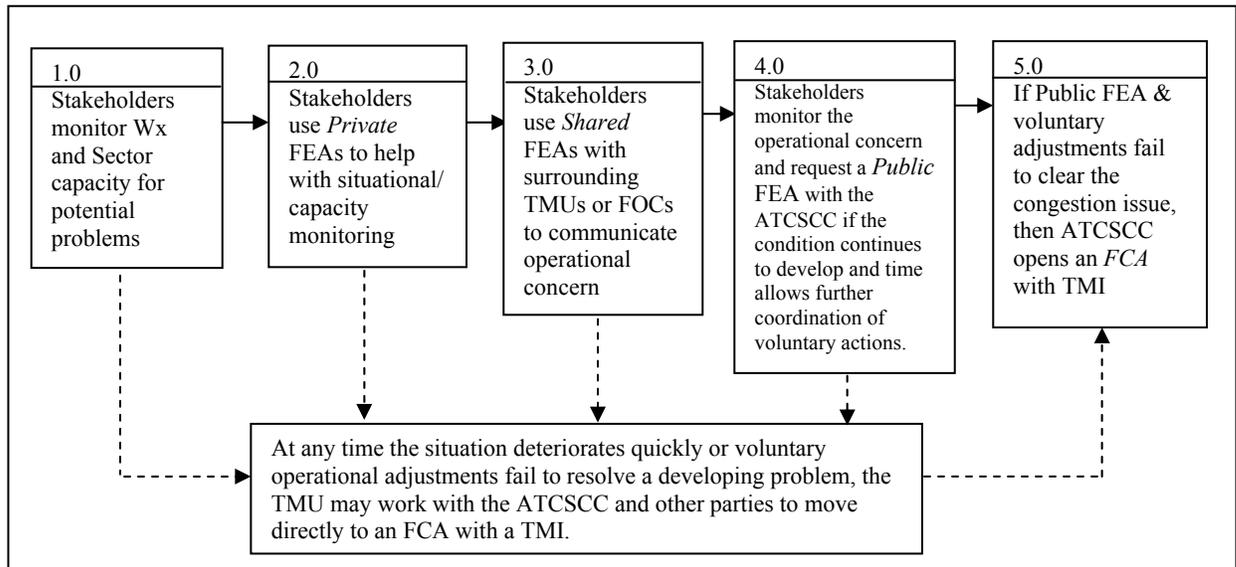


Figure 1-1. Functional Flow Diagram of Common FEA/FCA Procedures

More information on the FEA/FCA Concept of Operations can be found at:

<http://www.metronaviation.com/cdm/Workgroups/FCA-Reroute.html>

Monitoring FEAs/FCAs:

Once an FEA/FCA is built, ATC/traffic management personnel or flight dispatch personnel can monitor a regularly refreshed dynamic list of all flights affected by that particular FEA or FCA. The ETMS updates this list periodically and everyone sees the same data. A sample FEA Dynamic Flight List is shown in Figure 1-2.

ETMS tracks certain additional data about the flights involved with an FEA/FCA or reroute. This data includes:

- For an FEA/FCA, flights that have dropped out of the FEA/FCA.
- For a reroute, flights that “conform” to the reroute requirements.
- User-entered data, such as an approval for an exception to a reroute.

ACID	ETD	ENTRY	ABBR ROUTE
BTA2191	P1712	1712	IAH-LFK4.LFK-SDF
COA674	P1706	1706	IAH-LFK4.LFK-ORD
BTA3242	P1702	1702	IAH-LFK4.LFK-MKE
BTA7893	P1707	1707	IAH-LFK4.LFK-MEM
CHQ7675	P1751	1751	IAH-LFK4.LFK-IAD
COA358	P1709	1709	IAH-LFK4.LFK-DCA
DAL1636	P1759	1759	IAH-LFK4.LFK-CVG
BTA2039	P1702	1702	IAH-LFK4.LFK-CMH
BTA2652	P1707	1707	IAH-LFK4.LFK-BNA
COA1526	P1714	1714	IAH-LFK4.LFK-BDL
BTA2523	P1702	1702	IAH-GIFFA1.GIFFA-DFW
AAL1238	P1709	1709	IAH-GIFFA1.GIFFA-DFW
CAA151	P1722	1722	IAH-GIFFA1.GIFFA-DFW
SWA286	P1709	1709	HOU-LFK4.LFK-BNA
N6114A	P1738	1738	HOU-LFK4.LFK-5AR1
N335WH	P1740	1740	CXD-AEX2.AEX-OCF

Figure 1-2. Sample FEA/FCA Dynamic Flight List

Dynamic Flight Lists:

The ability to filter and sort the Dynamic Flight List can be of great value to individual flight dispatchers or ATC/traffic managers.

*Flight dispatchers* will want a *dynamic*, constantly refreshed, list they can monitor to get information on flights to or from specific airports, or even to get information on individual flights. They will use this information to help determine which flights may need to be rerouted, and then issue new routes or trajectories as appropriate.

*Traffic management personnel* at TMUs may prefer to filter the FEA/FCA flight list for only those flights that traverse their Air Route Traffic Control Center (ARTCC or “Center”). ATC/traffic managers are often more interested in the *Timeline* function of the FEA or FCA. The timeline information shows counts for traffic crossing an FEA or FCA boundary in pre-set ‘time buckets’ (e.g., each 15-minute segment). This allows traffic management personnel to see clearly when and where traffic flows may become congested.

Background Summary:

In summary, FEAs and FCAs provide system stakeholders with a mechanism to analyze the traffic expected in areas of severe weather, heavy volume or various other constraints, and plan necessary actions accordingly.

## **1.4 Document Organization**

Section 2 of this document reviews FEA/FCA practices; that is, what various users are doing with FEAs and why. In essence, Section 2 is an applications summary of best practices and ideas.

Appendices:

Appendix A provides more traditional user guide information; that is, how to use and manipulate some of the basic FEA/FCA tool functions.

Appendix B references other resources for FEAs/FCAs, including training material, procedures, and the concept of operations.

Appendix C contains a Glossary of abbreviations, acronyms and identifiers used in this document.

Appendix D acknowledges in general the many facilities and Customer organizations who have contributed to this Applications Guide document.

## Section 2 — FEA/FCA Practices

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This section describes how ATC/traffic managers and flight dispatchers actually use the Flow Evaluation Areas and Flow Constrained Areas (FEA/FCA). It presents actual examples to add a practical emphasis to the document. A little information is provided regarding how certain FEA or FCA functions are performed, but the real focus of this section is on the practices/scenarios themselves. Controllers and Flight dispatchers are bright, action-oriented people, and they can draw their own conclusions regarding how certain examples described in this section might apply best to their own situations.

The scenarios and suggestions presented here are divided into seven basic categories to organize presentation to the reader. The seven categories are:

- 2.1 Restrictions/Miles-In-Trail (MIT) Management
- 2.2 Weather Avoidance
- 2.3 Route Monitoring
- 2.4 Traffic Flow Monitoring
- 2.5 Arrival/Departure Flow Management
- 2.6 Military Special Use Airspace Management
- 2.7 Special Events Management

## 2.1 Restrictions/Miles-In-Trail Management

There have been many instances of FEAs being used to determine and justify the need for traffic management initiatives (TMIs) such as Miles-In-Trail (MIT) restrictions. The FEA can then be used to further define, monitor and manage the TMIs.

### 2.1.1 Examples

The ATCSCC has asked for FEAs to help determine the need for some MIT restrictions and to share the reasoning with involved Facilities and NAS Customers. The FEA allows ATC/traffic managers to clearly show the actual count and situation developing and thereby more easily explain to adjacent facilities or customers why restrictions are needed.

**Important Note:** Experience has already shown that more “sharing” of FEAs has led to reduced restrictions and increased cooperation between ATC/traffic managers and NAS customers to jointly resolve problems.

#### FEAs Used by the ATCSCC for Restriction Monitoring:

In general, the ATCSCC will build an FEA or FCA whenever they propose or issue a traffic flow initiative – MIT restrictions or reroutes. These ATCSCC National Traffic Management Log (NTML) entries from JAN/FEB04 provide some examples of restriction being monitored/supported via FEAs:

**02/16/2004 00:0022      Log Entry      0106**  
PHX 2324 RSTN. CHECKED WITH ZAB ON PROGRESS AND ZAB INFORMS RSTN IS WORKING SUFFICIENTLY FOR THEM. WILL CONTINUE TO MONITOR WITH FEA.

**01/22/2004 00:0024      Area Log      2344**  
ZFW CALLED BACK AND ADVISED THAT THE SECTOR IS NOW WELL OVER CAP OF 13 FOR 30 CONSECUTIVE MINUTES AND THEY ARE UNABLE TO COME OFF THE RESTN. A FEA IN ADDITION TO THE MAP SUPPORTS THE MIT RESTRICTION. IAH ADVISED.

**01/16/2004 00:0015      Area Log      2157**  
DTW JUSTIFICATION: FEA DATA SHOWS 10 FLIGHTS IN A 15 MINUTE PERIOD FOLLOWED BY 12 FLIGHTS IN A 15 MINUTE PERIOD ARRIVING DTW OVER POLAR IN THE RSTN PERIOD. THE MIT RSTN WILL KEEP THE FEEDER FROM BEING OVERWHELMED.

See Figure 2-1 as an example of this FEA for MIT.

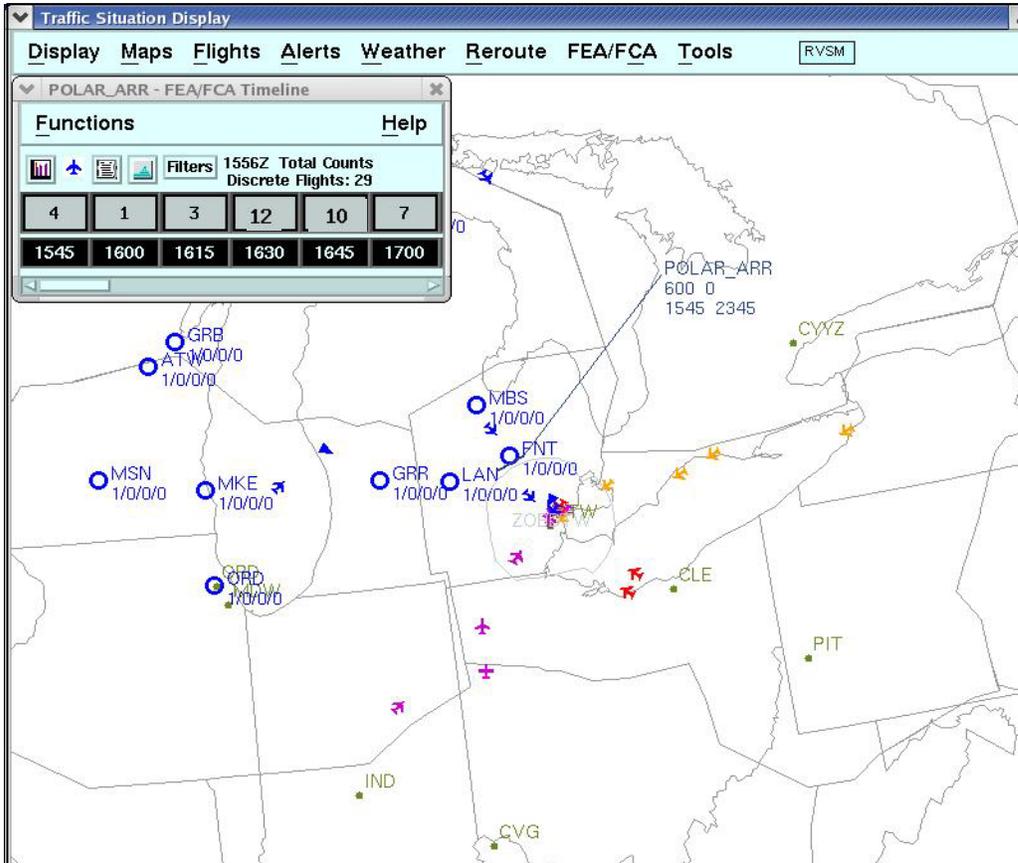


Figure 2-1. FEA for MIT justification

Other examples, where restrictions were **not approved** are noted in NTML Entries from MAR2004. In the second example, an FEA with specific flight information for tactical action is used in place of generic restrictions.

**March date/2004 00:00 Sever Wx Summary of Activity**  
 DAY: ZZZ HAD TWO REQUESTED ADZY FOR ZZZ02/ZZZ65, REVIEW OF FEA AND MONITOR ALERT SHOWED NO NEED DUE TO LOW VOL. ZZZ ADVISED TO MONITOR AND CALL REAL TIME IF NEEDED.

**March date/2004 00:00 Sever Wx Summary of Activity**  
 LATELY, ZZZ HAS BEEN REQUESTING THAT THIS SAME INITIATIVE BE TAKEN FOR 12 HOURS OR MORE EVERY DAY, REGARDLESS OF ANY ADDITIONAL ACTIVITY. THE AGREED UPON PROCEDURE, WHICH HAS BEEN WORKED OUT WITH THE MTO, HAS BEEN TO HAVE ZZZ CREATE AN FEA, CALL SVRWX. THIS WILL ALLOW ZZZ TO DYNAMICALLY MOVE AIRCRAFT AS NEEDED.

FEAs Used by Local FAA ARTCCs for Restriction Monitoring:

Some facilities similarly report that, in some instances, when they build an FEA over a perceived area of risk and then pull a list and timeline of affected flights, they actually have determined that they may not need a TMI after all. The dynamic list or timeline provides more specific detail and counts regarding which flights will be arriving in the affected area and when. If, for example, there is a request for 30 MIT, but an FEA's

dynamic list shows only three or four aircraft in the affected area in the next 30 minutes, then the MIT may be avoided.

Two examples of FEAs negating the need for restrictions are shown below:

**03/26/2004 00:00 Summary of Activity**

DAY: EARLY DISCUSSION OF TRANS-CON THROUGH ZKC, DECIDED TO ISSUE A PUBLIC FEA (TRANSCON1) AND WAIT ON REQUIRED REROUTES. THE USER FILINGS THROUGH THE DAY SHIFT WERE ADEQUATE TO AVOID THE NEED TO ISSUE ANY OFFICIAL REROUTES FOR THIS TRAFFIC.

**03/27/2004 00:00 Summary of Activity**

DAY: REROUTES KEPT TRAFFIC OUT OF ZKC AND NORTH. SEVERAL FEAS WERE BUILT AND MADE PUBLIC. ONE WAS TO PROTECT ZKC AND WORKED TO ALLOW THE CUSTOMERS TO UPT SOUTH. THIS FEA WAS MODIFIED SEVERAL TIMES AS CONDITIONS CHANGED. AFTER THE 1615Z SPT, ZFW REQUESTED A GTH (OR LIKE PLAYBOOK REROUTE). HOWEVER THEY CHANGED THEIR MIND AS THE FEA MET THEIR NEEDS.

In these cases, public or shared FEAs enabled collaborative problem solving, and unnecessary restrictions were avoided. See Figure 2-2 as an example of the ZKC Transcon FEA.

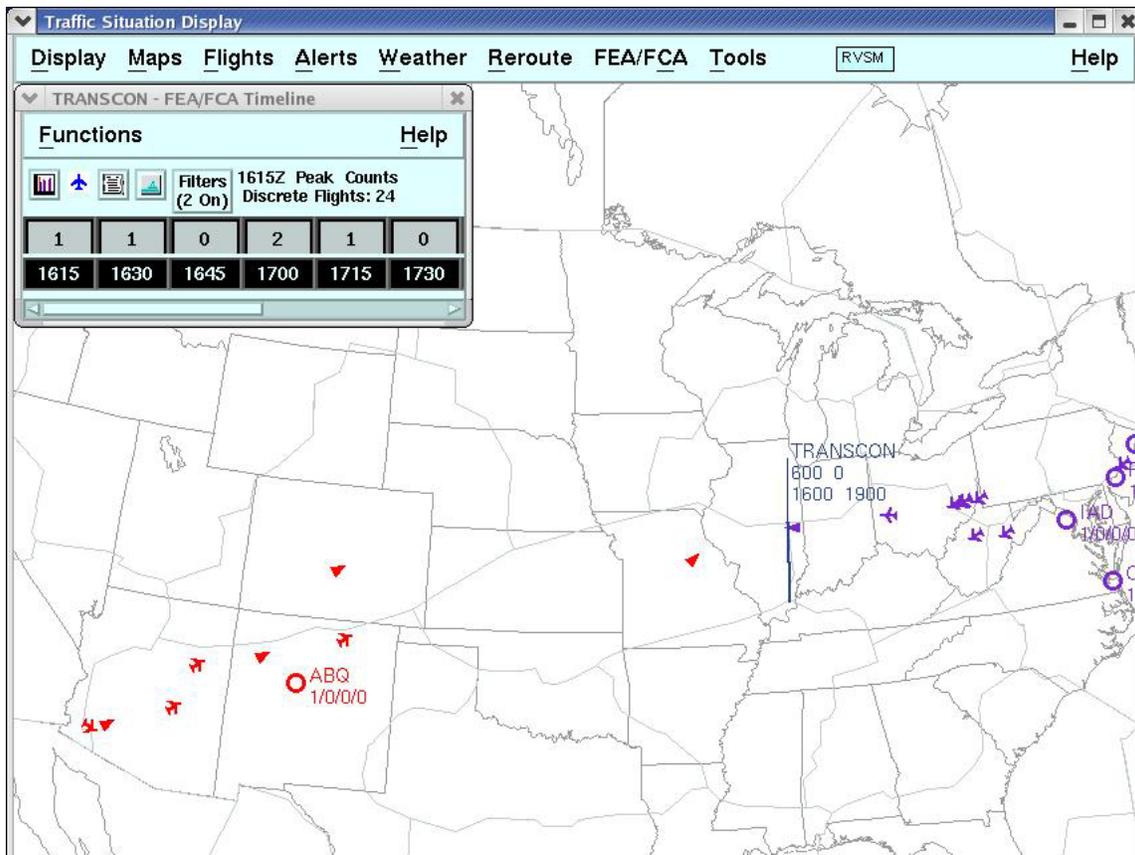


Figure 2-2. Transcon FEA to monitor for restrictions

FEAs used to help with “Timing” of restrictions:

FEAs have been used by several Traffic Management Units (TMUs) to help determine exactly *when* a TMI might be warranted.

*Example: FEAs for Tactical Timing of Restrictions:* Atlanta Center TMU (ZTL) builds and monitors FEAs to determine when MIT will be needed. This allows ZTL to more accurately determine not just the amount of traffic that indicates a need for a TMI, but the precise times during which that TMI will likely be needed.

*Example: Saved FEAs for Timing Restrictions:* Minneapolis Center TMU (ZMP) uses ‘saved’ FEAs to monitor arrival flow into O’Hare Airport (ORD). When Chicago Center (ZAU) puts in TMIs to ORD, ZMP recalls these saved FEAs to determine *when to pass back* MIT restrictions to Denver Center (ZDV) or Toronto Center (CZY). The larger FEA arc on the left is used to monitor the flow from ZDV when ZAU requires MIT. If the volume requires, ZMP will pass back 15 MIT to ZDV. The FEA depicted by the inner line is used to assist ZMP in releasing internal departures into the overhead stream. Another FEA arc at the top right is activated when ZAU requests 25 MIT over Traverse City (TVC). This FEA will monitor the traffic arriving from Canada; MIT can be requested from CZY when needed.

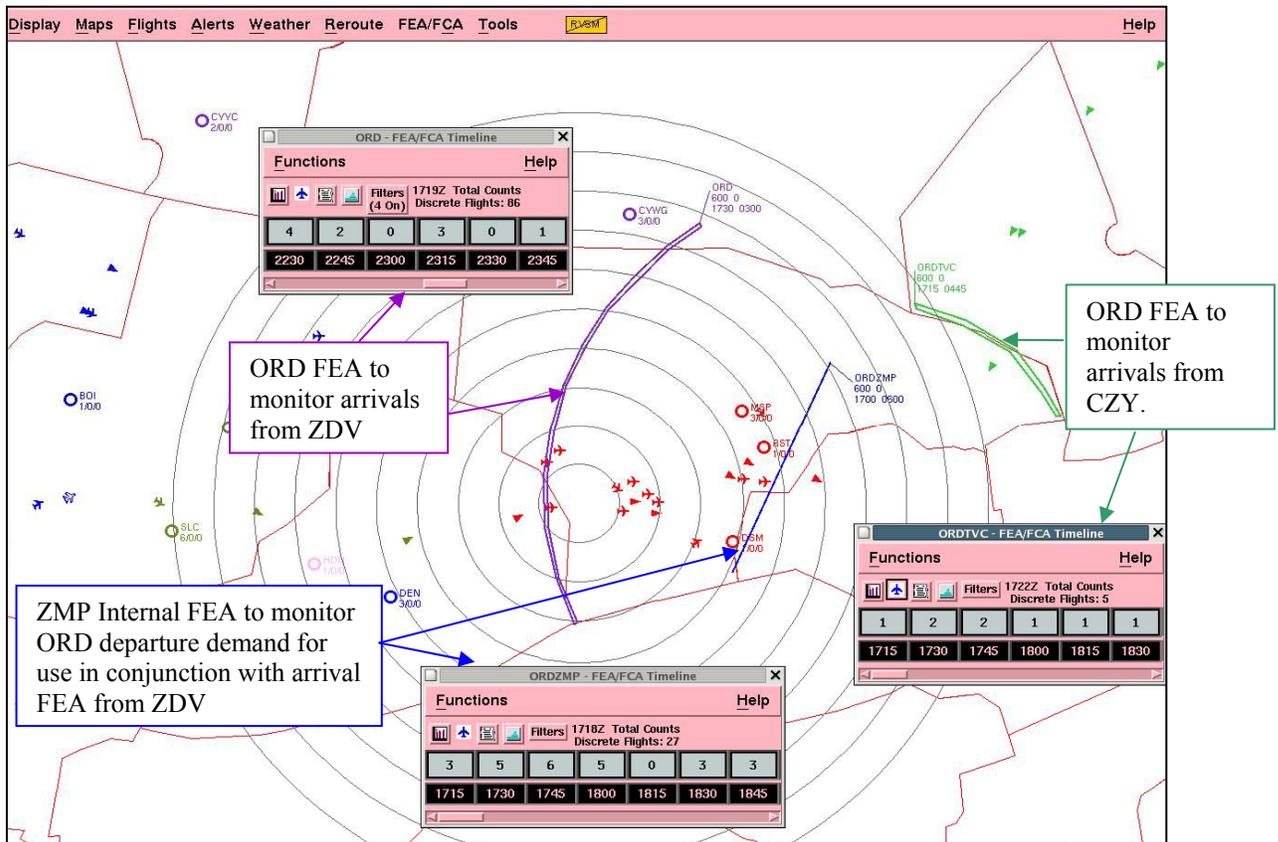


Figure 2-3. ZMP saved/recalled ZAU arrival FEAs

**Hint:** How to draw an irregularly shaped FEA (e.g., an arc like those seen in Figure 2-1): An easy way to draw an irregularly shaped FEA like an arc is to hold down the left mouse button while moving the pointer to form the desired shape.

FEAs used to help with adjacent facility requirements:

Some TMUs build FEAs to help them monitor and comply with requirements from adjacent facilities; here are some examples.

ZTL uses the FEA filtering ability to identify airports within their facility to assist in determining which initiatives are needed and which facilities to put on ‘call for release’ status. In order to meet MIT requirements for an adjacent Center, they draw an FEA on a boundary and then filter that FEA for airports of specific interest.

*See Appendix A-2 for more information on Filters.*

Fort Worth Center TMU (ZFW) reports building an FEA along their boundary with Memphis Center (ZME) with color-coded sub-filters to distinguish flights by destination to assist in monitoring compliance with MIT restrictions and to assist in releasing ZFW departures into the overhead stream.

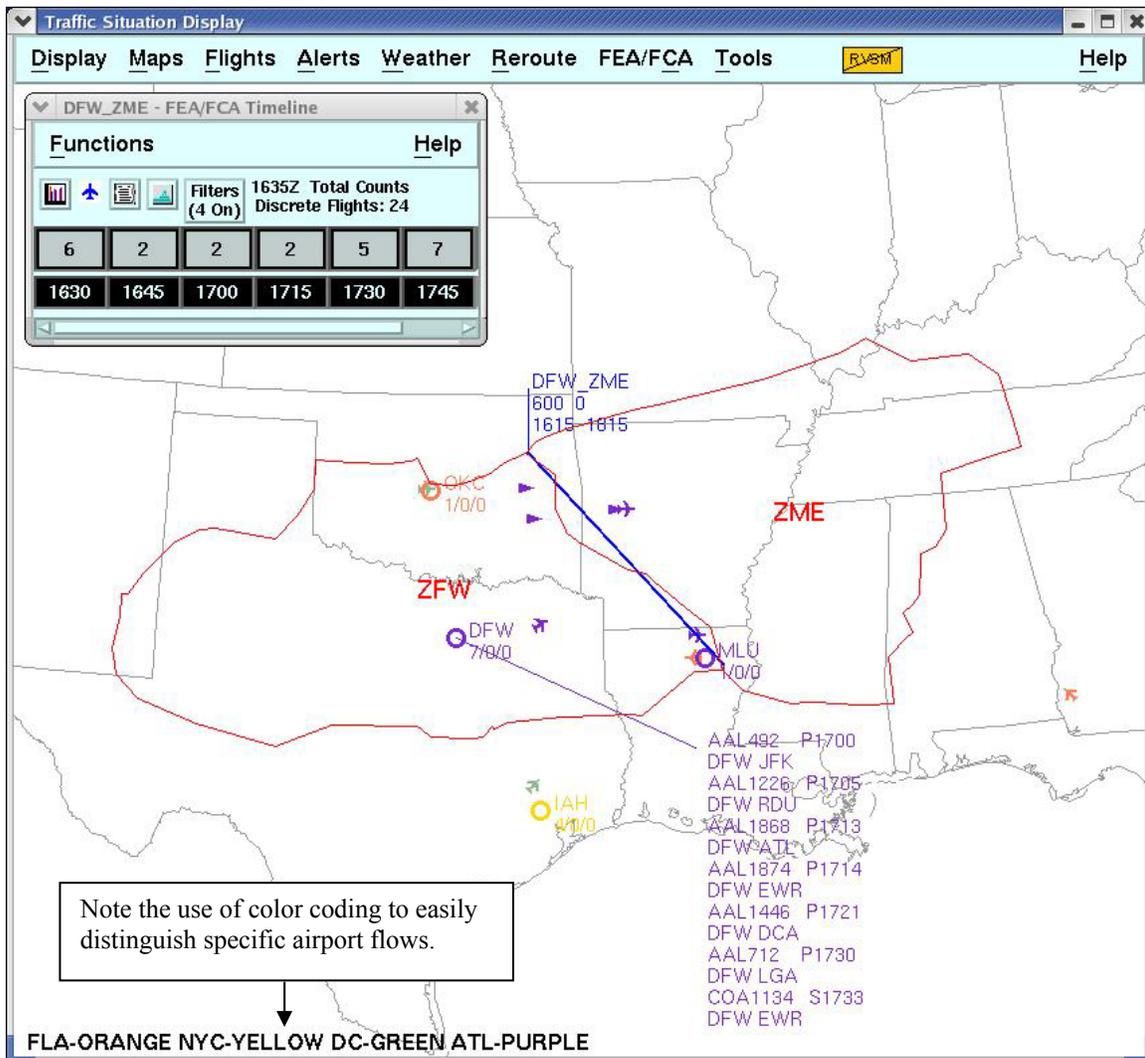


Figure 2-4. ZFW FEA for monitoring MIT compliance

**Important Note:** MIT initiatives are usually put out one and half to two hours in advance. There have been instances where once an FEA has been created and initiatives issued, the traffic count numbers change by the time the actual restriction is ready to take place. This indicates the value of the “dynamic” nature of FEA lists, but it also emphasizes the need to continually monitor those lists for changes and then adjust initiatives accordingly.

## 2.2 Weather Avoidance

One of the most common uses of FEAs or FCAs is to provide a list of flights affected by a weather event that is constraining flights in a certain area. An FEA is drawn around the area of weather and a dynamic list of flights in the FEA is provided (see Figure 2-5). The dynamic list will indicate which flights need to be rerouted to avoid the weather area.

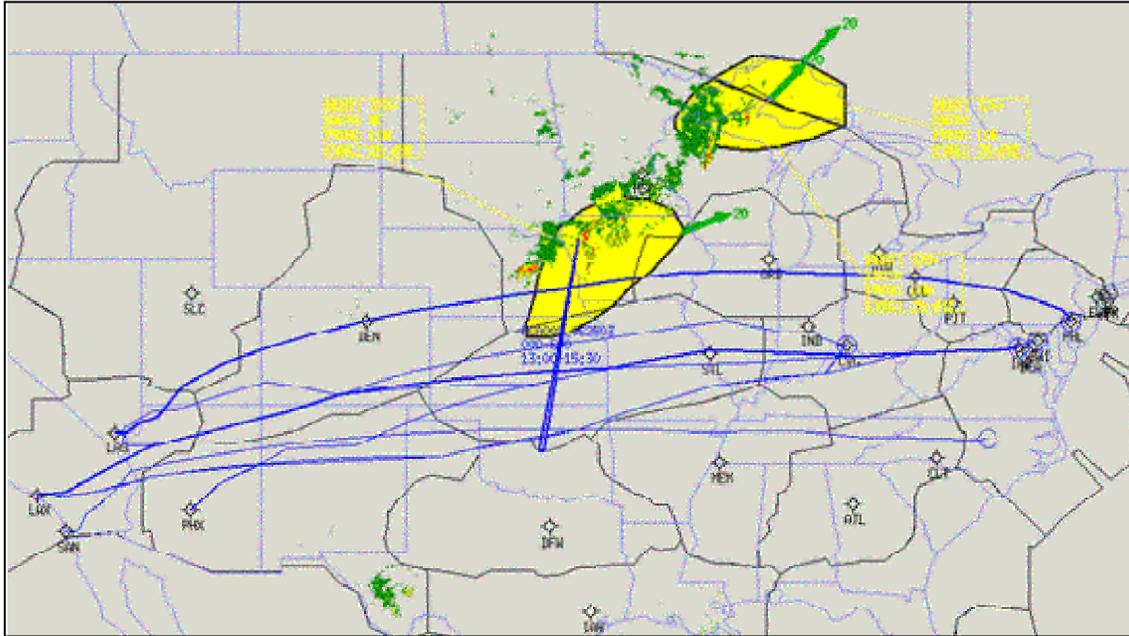


Figure 2-5. Weather FEA

### Weather monitoring from the Flight Dispatcher's perspective:

A *Dynamic Flight List* will show specific flight information.

Flight Dispatchers will be particularly interested in specific flights or groups of flights that may need to be rerouted because of weather. They will likely use the *FEA/FCA Dynamic Flight List* with appropriate filters to determine flights of interest. They can then take necessary actions to help those flights.

ACID	ETD	ENTRY	ABBR ROUTE
BTA2191	P1712	1712	IAH-LFK4.LFK-SDF
COA674	P1706	1706	IAH-LFK4.LFK-ORD
BTA3242	P1702	1702	IAH-LFK4.LFK-MKE
BTA7893	P1707	1707	IAH-LFK4.LFK-MEM
CHQ7675	P1751	1751	IAH-LFK4.LFK-IAD
COA358	P1709	1709	IAH-LFK4.LFK-DCA
DAL1636	P1759	1759	IAH-LFK4.LFK-CVC
BTA2039	P1702	1702	IAH-LFK4.LFK-CHH
BTA2652	P1707	1707	IAH-LFK4.LFK-BNA
COA1526	P1714	1714	IAH-LFK4.LFK-BDL
BTA2523	P1702	1702	IAH-GIFFA1.GIFFA-DFW
IAAL1238	P1709	1709	IAH-GIFFA1.GIFFA-DFW
CAA151	P1722	1722	IAH-GIFFA1.GIFFA-DFW
SWA286	P1709	1709	HOU-LFK4.LFK-BNA
N6114A	P1738	1738	HOU-LFK4.LFK-SAR1
N335UH	P1740	1740	CXD-AEX2.AEX-OCF

Figure 2-6. FEA/FCA Dynamic List

Weather monitoring from the ATC/traffic manager’s perspective:

An FEA/FCA Timeline will show when and how many flights intersect the FEA/FCA.

ATC/traffic managers will also use the Flight List as described above to monitor conforming/non-conforming flights. Each TMU may filter for flights traversing or departing from their own Center area so they can determine which flights still need action.

ATC/traffic managers will also depend heavily on the FEA/FCA Timeline information to show how many flights are scheduled to be in an FEA/FCA at any specific segment of time (i.e., within a given 15-minute time bucket). This allows them to determine what action is needed and when/where congestion may occur.

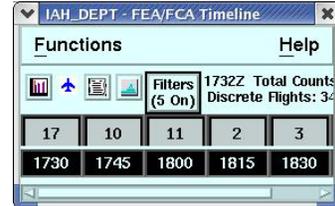


Figure 2-7. FEA/FCA Timeline

### 2.2.1 Examples

The ATCSCC may issue FCAs or Public FEAs to reroute traffic around areas of severe weather or coordinate alternatives to restrictive reroutes. A typical FEA ADVZY to reroute traffic around an area of Weather (in this case via User Preferred Trajectory - UPT) is shown below in Figure 2-8.

**ATCSCC Advisory**

**ATCSCC ADVZY 013 DCC 04/20/04 ROUTE ADVISORY FEA\_DCC\_ZKC\_RMD**

RAW TEXT: ATCSCC ADVZY 013 DCC 04/20/04 ROUTE ADVISORY FEA\_DCC\_ZKC\_RMD

FEA: DCC ZKC CONSTRAINT

IMPACTED AREA: ZKC

REASON: TSTMS

INCLUDE TRAFFIC:

SECONDARY FILTER: NE2NW ZBW/ZNY/ZDC/ZID/ZOB TO ZOA/ZSE/ZLC/ZDV  
NE2LA\_AB ZNY/ZDC/ZID/ZOB TO ZLA/ZAB

VALID: FEA TIME 1400-1800

PROBABILITY OF EXTENSION: MODERATE

REMARKS: THIS IS A COLLABORATIVE INITIATIVE. USERS ARE EXPECTED TO IDENTIFY THEIR FLIGHTS INCLUDED IN THIS FEA AND MAKE THE APPROPRIATE ROUTE CHOICE.

ROUTE(S):

NE2NW.....UPT NORTH OF THE FEA

NE2LA\_AB.....UPT SOUTH OF THE FEA

201212-201800

04/04/20 12:17

Figure 2-8. Public FEA from ATCSCC with UPT options for Weather

**Important Note:** Information on current ATC Advisories is available at the ATCSCC public web site - <http://www.fly.faa.gov/adv/advADB.jsp> .

Other NTML Examples of FEAs/FCAs for Weather:

Some examples of FEAs or FCAs leading to successful coordination or collaboration to resolve weather issues are shown in the log entries below:

**05/22/2004 00:00Sever Wx      Area Log      2115**  
ZDV CALLED TO CONFERENCE ZMP REGARDING FEA ZDVWX. ZMP TACTICALLY ROUTED SIX FLIGHTS SOUTH TO GLD OR HLC TO AVOID WEATHER NORTH OF DEN. - LNK: ZDV/ZMP

**05/22/2004 00:00Sever Wx      Area Log      1414**  
Shift Summary: DAY SHIFT- DUE TO UNEXPECTED ZKC WX. ALSO CREATED A PUBLIC FEA TO ADDRESS ANY OTHER TRAFFIC ON J80 REQUESTING THAT THEY FILE SOUTH OF J80. THE USERS DID A GOOD JOB OF TAKING APPROPRIATE ACTIONS TO AVOID THE CONSTRAINED AREA IDENTIFIED IN THE FEA.

**04/20/2004 00:00Sever Wx      Area Log      2220**  
CONTACTED THE FOLLOWING AIRLINES REGARDING PUBLIC FEA:  
COA/DAL/JBU/SWA/USA THEY ALL INDICATED THEY HAVE RECEIVED THE PUBLIC FEA AND THAT THEY ARE WORKING THE ISSUE WITH THEIR DISPATCHERS.  
OBSERVATION OF THE EXAMINED NUMBER OF FLIGHTS FOR THE FEA INDICATE THE NUMBERS ARE SLOWLY DECREASING AS AIRLINES REROUTE AROUND THE IMPACTED AREA.

FEAs adjacent to Weather areas:

TMUs have discovered that building FEAs adjacent to areas of severe weather can give them a good perspective on how deviating flights will affect sector volume in sectors just adjacent to the weather. Some examples are described below.

Kansas City Center TMU (ZKC) reports use of FEAs not just over the weather area itself, but also on the outskirts or sectors at the edge of the weather area. They report: “This is valuable information because customers are good about filing around the weather, creating potential problems just outside the weather area.”

ZMP similarly uses several different FEAs during severe weather events; one to monitor and reroute those flights that are filed through the weather area, and one or more to monitor aircraft counts in the airspace adjacent to the actual weather. In the Figure 2-9 below, FCAs were first built around the actual weather to show flights that needed to be moved. “Straight line” FEAs were then drawn on the north and south side of the weather to evaluate volume impact in those adjacent sectors, which could trigger the need for additional TMIs/MIT. Again, the timeline/count information for each of the adjacent sector FEAs can provide details about when and how much traffic will be arriving in those areas just next to the weather.

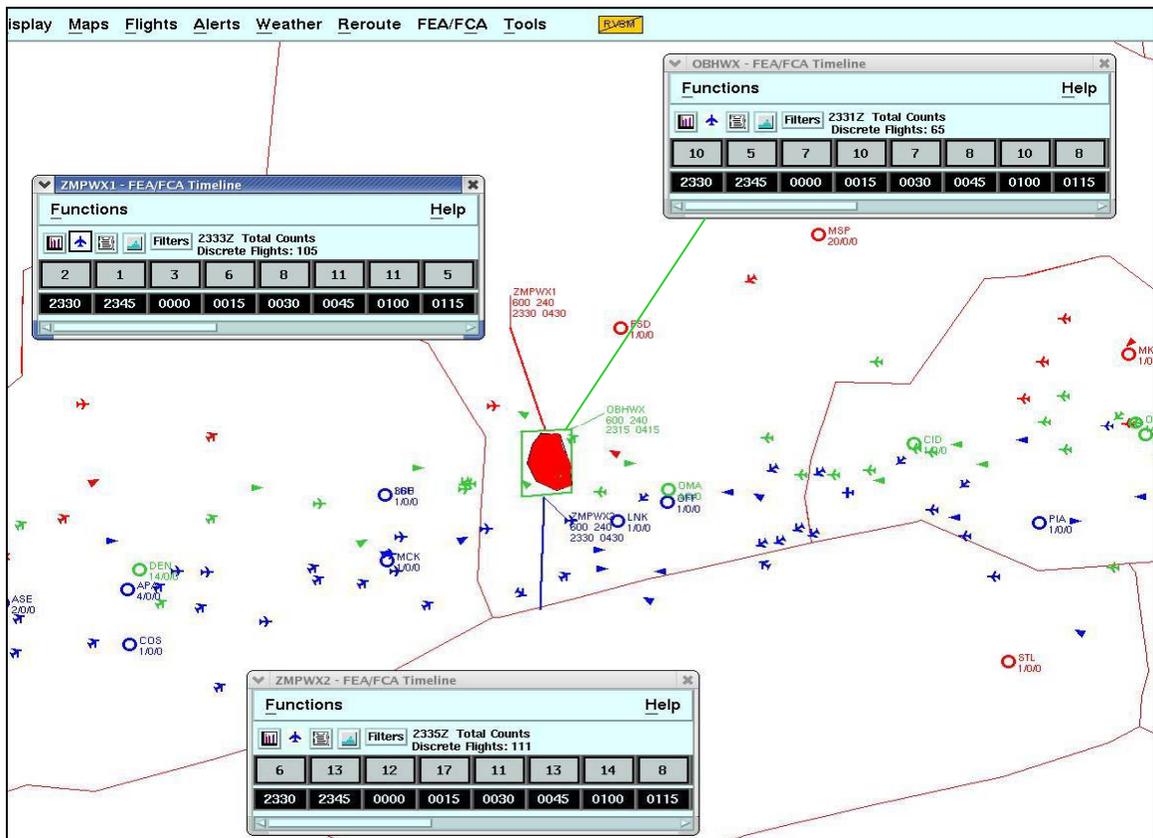


Figure 2-9. Adjacent Sector Impact FEAs

Example of Weather Routing at ZKC:

ZKC also offers another idea for monitoring traffic and reroute requirements due to weather. They use FEAs to show where the weather is and also to show more precisely where rerouted aircraft should fly to avoid the weather. Here is their description:

Create an FEA for the area of interest (could be a NAS element like a sector or one drawn specifically for the weather). Then create a secondary filter that shows all flights that are not filed over a specific fix or set of fixes. Using this method, you would be able to monitor both the aircraft that are on a good route as well as those that still need to be rerouted. From there, the FEA/FCA could be shared with other facilities that have affected flights.

As an example, you could draw an FEA from the Pawnee City (PWE) vortac to the Wichita Falls (SPS) vortac representing a line of weather. For this example, look at just westbound flights. On the parameters page, set the altitude range from FL 240 to 600. On the primary filters page, on the line "heading is within," type in 260 degrees +/- 40. Then create a secondary filter. Change "traverses any of" to "traverses none of" and add Salina (SLN), Ponca City (PER), and Oklahoma City (IRW). Those fixes would represent holes in the weather. All flights highlighted by the secondary filter would be aircraft that still needed routes to avoid the weather. The residual flights would be all those that are already filed over one of the fixes around the weather.

FEAs for other Weather Phenomena:

Anchorage Center (ZAN) has used FEAs to depict areas where volcanic ash is reported or suspected so they can determine which flights are going to enter that airspace and assist them in routing around it.

**Important Note:** When routing traffic around an area of weather, ATC/traffic managers should be careful to control when and how the traffic merges back into a required flow. If left undefined (e.g., if reroute merely specifies “UPT” without further instructions), it may be very difficult to merge the traffic back into a managed flow and could cause multiple problems elsewhere.

Example from ZMP:

In the following scenario, instead of using a Playbook (which pins the arrivals down on a specific route), the ATCSCC elected to draw an FCA at the SKETR arrival gate and request NAS users to file UPTs around it to other gates. The weather was a large cell situated between Sioux Falls (FSD) and O’Neill (ONL). What later transpired was an unorganized, random UPT filing of all arrivals. In Figure 2-10 below, notice how many of the routes lines **cross** each other. Also notice how the arrivals (with no route lines attached) are entering the southern terminal sectors from all directions.

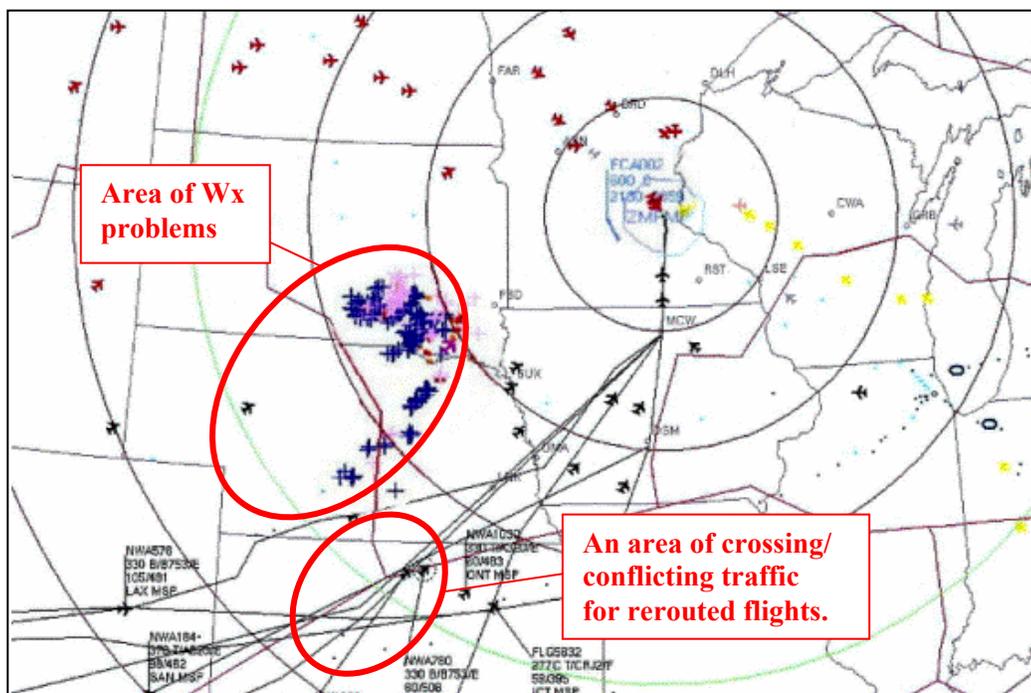


Figure 2-10. UPT Caution

This situation happened to occur at the same time that the daily ORD arrival push was coming through, which was also compressed into the same arrival sector due to the same weather cell. Flow was required, along with MIT, but was difficult because the arrivals were not restricted to specific routes. The figure does not show all of the other existing data blocks in those sectors.

Two possible solutions may have helped alleviate this problem:

- 1) UPT those arrivals to a specific fix, and then assign a route from there (SLN..OMA..MCW.KASPR2.MSP) ; **or**
- 2) Use the SKETR Playbook instead of, or in conjunction with, the FCA.

Along the same lines, ZFW points out that one flow management strategy is to “request or require users to file UPTs around an FEA/FCA.” And then they warn that “this strategy has significant risks when a large area of adverse weather exists or is forecasted to exist, since it can result in some users filing through the area with the expectation that a preferred route will not be blocked completely. In this situation, pilots will often request to deviate around the weather, and results in tactical reroutes that are difficult to manage and can create significant overloads for other sectors. Those users that do file around the weather on a UPT often generate random traffic flows that are very difficult to manage.”

**Important Note:** Again, it is important to emphasize that whenever weather-related FEAs are “shared” in advance, it may allow NAS Customers to see what traffic management personnel are planning and potentially help in solving the problem before it happens or becomes too serious.

## 2.3 Route Monitoring

Many facilities and the ATCSCC are using FEAs to monitor route compliance and route changes. This is a very typical scenario often related to reroutes due to weather or volume constraints.

### 2.3.1 Examples

#### Chokepoint FCA:

One good example of route monitoring with an FCA is the Chokepoint FCA. The issue that Chokepoint Routes were designed to address is the JFK/EWR traffic through Cleveland Center (ZOB). The Chokepoints were designed to get the traffic in order before entering ZOB so MIT could be managed in ZOB. Prior to chokepoints, many flights were on random routes entering ZOB causing MIT restrictions to often be ineffective and excessive on the users.

With Chokepoints available, the ATCSCC draws an FCA, basically a line that covers J584, J70, and J16. The FCA is filtered for JFK and EWR arrivals, and filtered to exclude the ZOB, ZAU and ZID traffic because those flights are internal traffic that ZOB fits into the flow. Then, the FCA details are examined by both a numbers list and a graph chart. Via the graph chart, it is very obvious where the peaks and valleys are. Then peak issues are discussed on the Operational Planning Telcon and a time is agreed for when MIT restrictions will need to be in effect.<sup>2</sup>

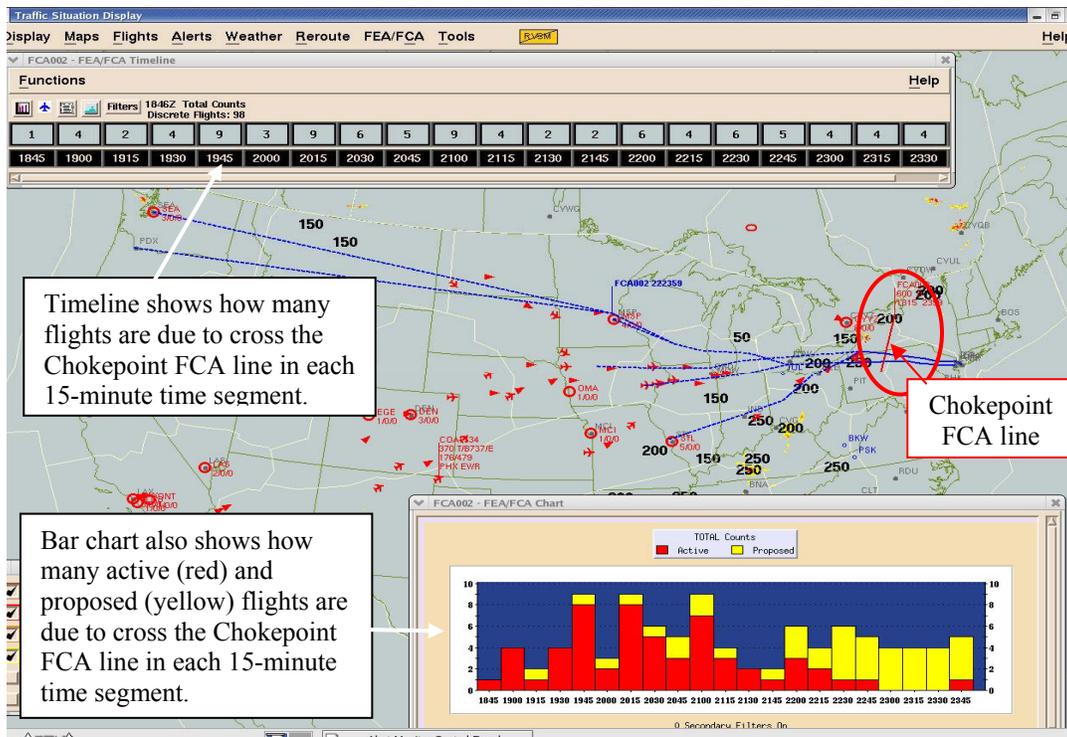


Figure 2-11. Chokepoint FCA

<sup>2</sup> NOTE: Use of Chokepoint FCAs has been successful in reducing both the time length of Chokepoints use as well as the amount of pass back MIT restrictions.

**Important Note:** There is a misconception by some that all flights to EWR/JFK must be on these chokepoint routes. That is not quite true. The chokepoints only apply to traffic transiting ZOB. Some flights may be on routes through ZID or Canada that miss ZOB and therefore do not have to be moved.

**Important Note:** The Chokepoint FCA is also a good example of using an FEA or FCA to contain a flow of traffic over a specific fix or airway within an FEA/FCA as opposed to the more common use of using an FEA/FCA to define airspace to be avoided.

The purpose of an FCA ADVZY is to define a specific required action. Generally, the required action is to avoid an area of concern (e.g., due to weather or volume). In some instances, however, FEAs/FCAs are used to confine traffic flows over certain points or routes. Some other examples of confining flows within an FEA/FCA include:

*DC Metro Area BKW FEA/FCA Example:*

FCAs have been built in the past to ensure that all traffic destined for the DC Metro area airports (IAD, DCA, BWI) from the West was routed over (Beckley) BKW. In this case, the FCA is built to get a list of flights and ensure they are all on the correct route over BKW, as opposed to the more common situation where flights are supposed to 'miss' the FCA.

*ZKC Weather FEA Example:*

ZKC similarly has used an FEA to ensure that traffic trying to weave through weather cells was all routed over a certain point as opposed to missing the FCA and flying into the weather, or missing the weather but in random directions. This ensured some degree of control over the flow and ensured that flights missed the most severe weather areas. (See explanation on p. 18.)

FEA to help manage reroute requirements:

ARTCCs use FEAs and their associated dynamic lists to ensure flights are on the correct route when leaving their airspace. A very simple and quick way to do this is shown in the Figure 2-12 FEA from ZOB. They simply drew an FEA over much of their entire airspace to capture and monitor a list of flights from the northeast that might need to be rerouted. In this instance the reroute was required for DFW/IAH traffic. They drew this FEA and then filtered for traffic destined to those two airports to ensure they all had the proper new routes.

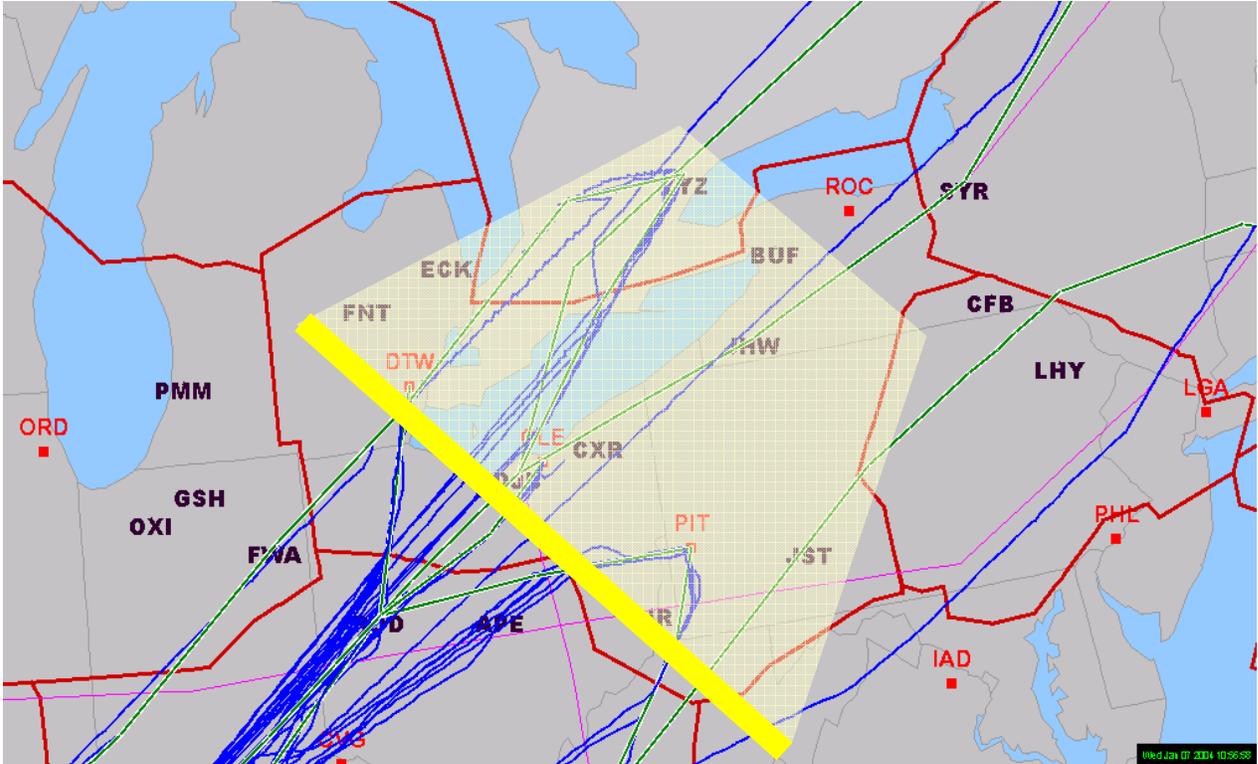


Figure 2-12. Global FEA at ZOB to capture reroute requirements to DFW/IAH.

## 2.4 Traffic Flow Monitoring

One of the most common uses of FEAs is for basic traffic flow monitoring. An FEA presents a dynamic picture of specified flows of traffic for TMUs to monitor. This enables traffic management personnel to adjust entire flows strategically with planned initiatives, or easily identify specific flights that can be moved or capped to tactically adjust the volume of traffic in a timely manner. This practice is dynamic because the FEA reflects changes as traffic is added or removed from the affected area.

### 2.4.1 Examples

The ZOB TMU is a heavy user of FEAs for flow monitoring. They have saved FEAs that they recall daily to monitor specific traffic flows into local airports or along the busy New York to Chicago route. (NOTE: In the absence of scripts to automatically regenerate these 'recalled' FEAs, the times have to be reentered once or twice a day.) Figure 2-13 shows eight FEAs saved for daily use. Note as an example, that the three FEAs on the right (numbers 6, 7, 8 -- circled) are filtered to monitor Chardon (CXR) arrivals into CLE from Boston (ZBW), New York (ZNY) and Washington (ZDC) Centers.

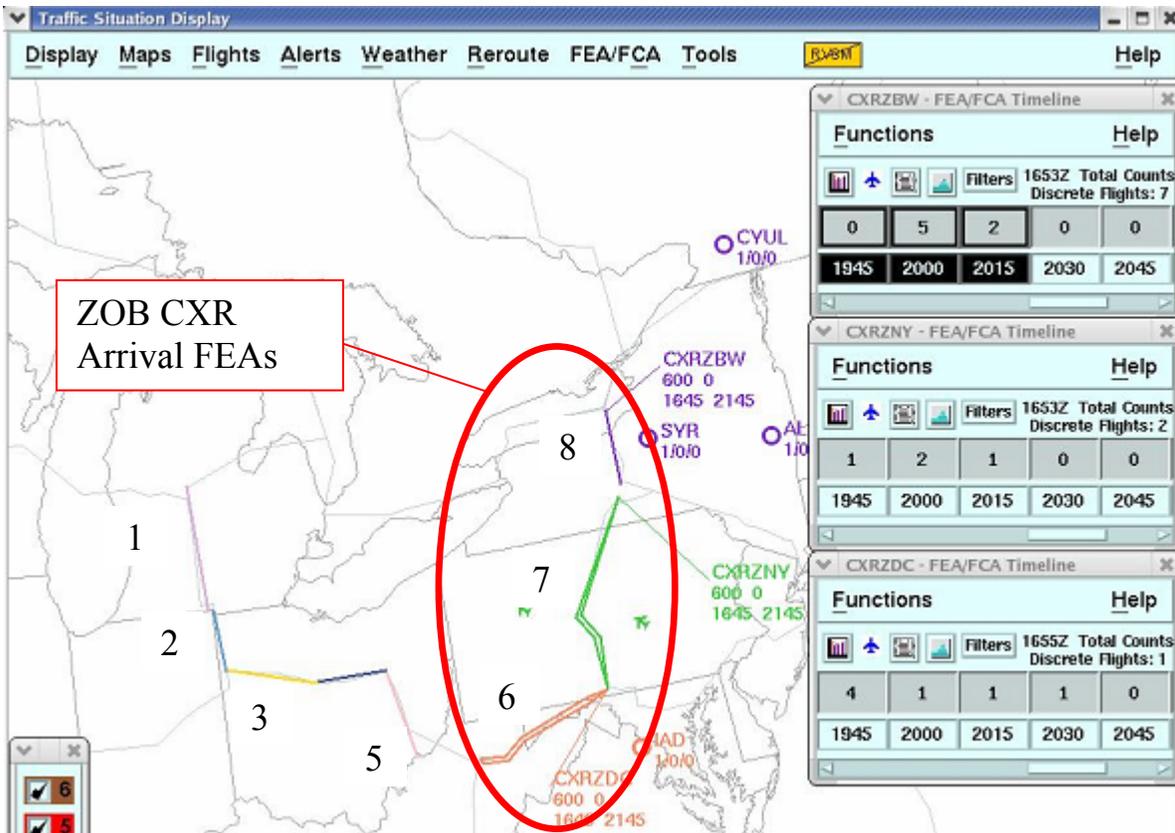


Figure 2-13. Example of 'saved and recalled' flow monitoring FEAs at ZOB

The FEA Timelines shown on the FEA in Figure 2-13 might be used to determine the impact to certain flows and whether traffic management initiatives are necessary. ZOB reports they occasionally use the timeline information to take more surgical actions as necessary. For example, if the timeline shows four or five arrivals grouped in one 15-minute bucket but fewer arrivals in succeeding time slots, they may call ZBW (for example) and ask that they make sure the four arrivals are spread out. They would, however, avoid issuing general MIT restrictions for all arrivals.

Also, the FEA timeline details may provide input to the TMU about whether they might avoid MIT restrictions by fix balancing. For example, if one fix was lighter than two other arrival fixes, then off-loading methods can be used to balance the flow and avoid more serious restrictions.

### **Important Notes:**

1. These flow monitoring FEAs are routinely intended for ‘private’ use only. However, if a situation looks threatening, sharing the appropriate FEA(s) could help adjacent facilities or NAS Customers plan a potential solution.
2. Many TSD users report the “save and recall” capability is a very valuable feature in the FEA/FCA toolset. Re-usable FEAs can be recalled daily or even seasonally as needed to aid in traffic management activities.
3. Multiple saved/recalled FEAs can lead to the problem of clutter on the TSD or CCSD if not carefully managed. Some facilities report, however, that the ability to filter on specific flights, city pairs, airways, direction of flight, etc., and to color code certain flows or certain flights, can be a big help to distinguish traffic flows of interest.

*See Appendix A for more info on how to use filters and how to save/recall FEAs.*

FEAs to help define sector resource needs:

Various facilities (Center, Terminal and Canadian) use FEAs to help determine sectorization or other resource needs. Operational area supervisors monitor FEA timelines to help determine predicted traffic rates. They might make decisions regarding sector splits, D-Side assistance, and trackers based on this information.

FEAs to help with display clutter and MAP support:

Several TMUs (ZTL, Jacksonville (ZJX), and others) have used FEAs to obtain a list in conjunction with Monitor Alert. ZTL reports that an advantage of FEAs in this case is that they can be rolled or unrolled to save space on the TSD desktop, and can provide a

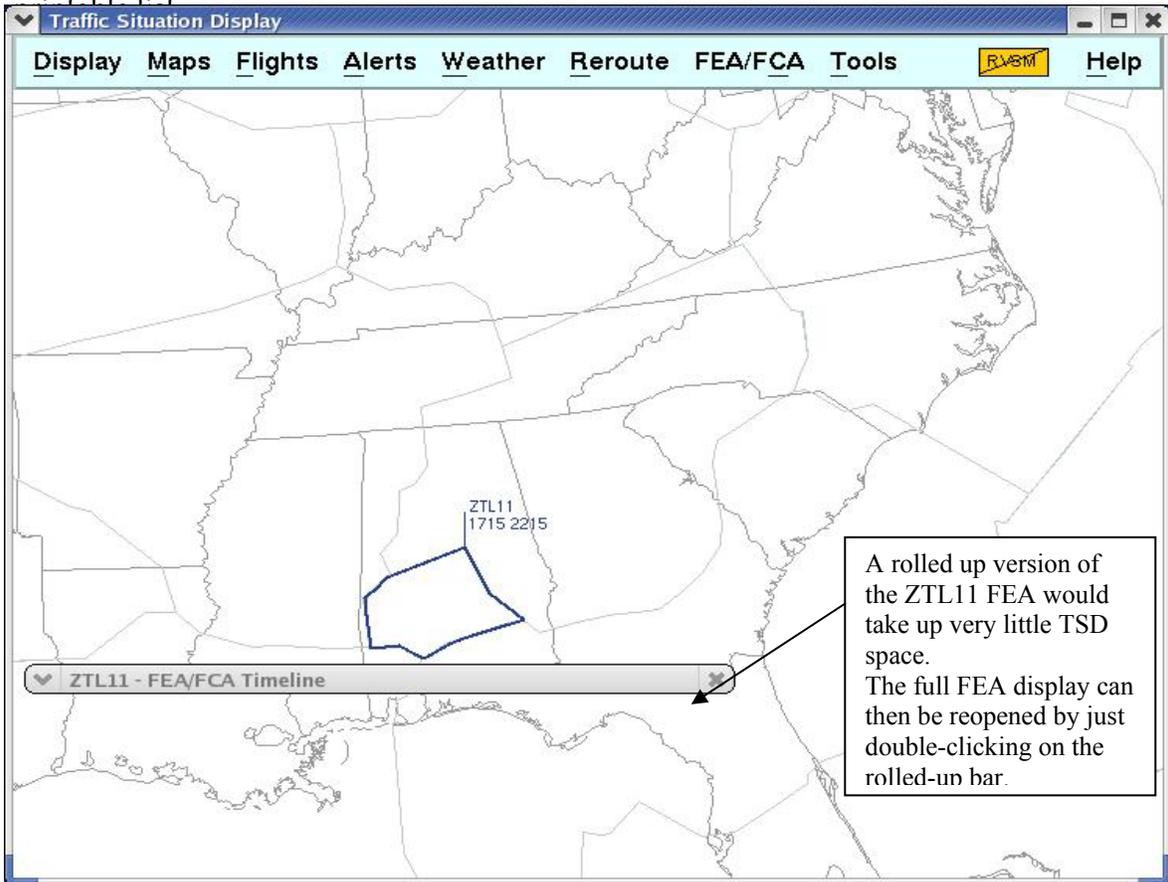


Figure 2-14. Rolling up FEAs to save space

It is not infrequent for facilities to design and implement new or modified sectors outside the standard chart change/ETMS update cycles. Rather than implement interim chart changes and/or emergency ETMS updates for the express purpose of loading new Monitor Alert Parameter (MAP) values, facilities can build FEAs using the polygon function to match the new sector airspace. Once these FEAs are built, facilities can then utilize the FEA timeline function to monitor 15-minute traffic counts in support of the MAP function. Once the various systems have been updated to reflect the new sectorization, then the FEAs can be discontinued. An example from ZDV is shown below in Figure 2-15. In this case, a proposed sector was drawn with an FEA and traffic counts for the proposal were monitored via the timeline function.

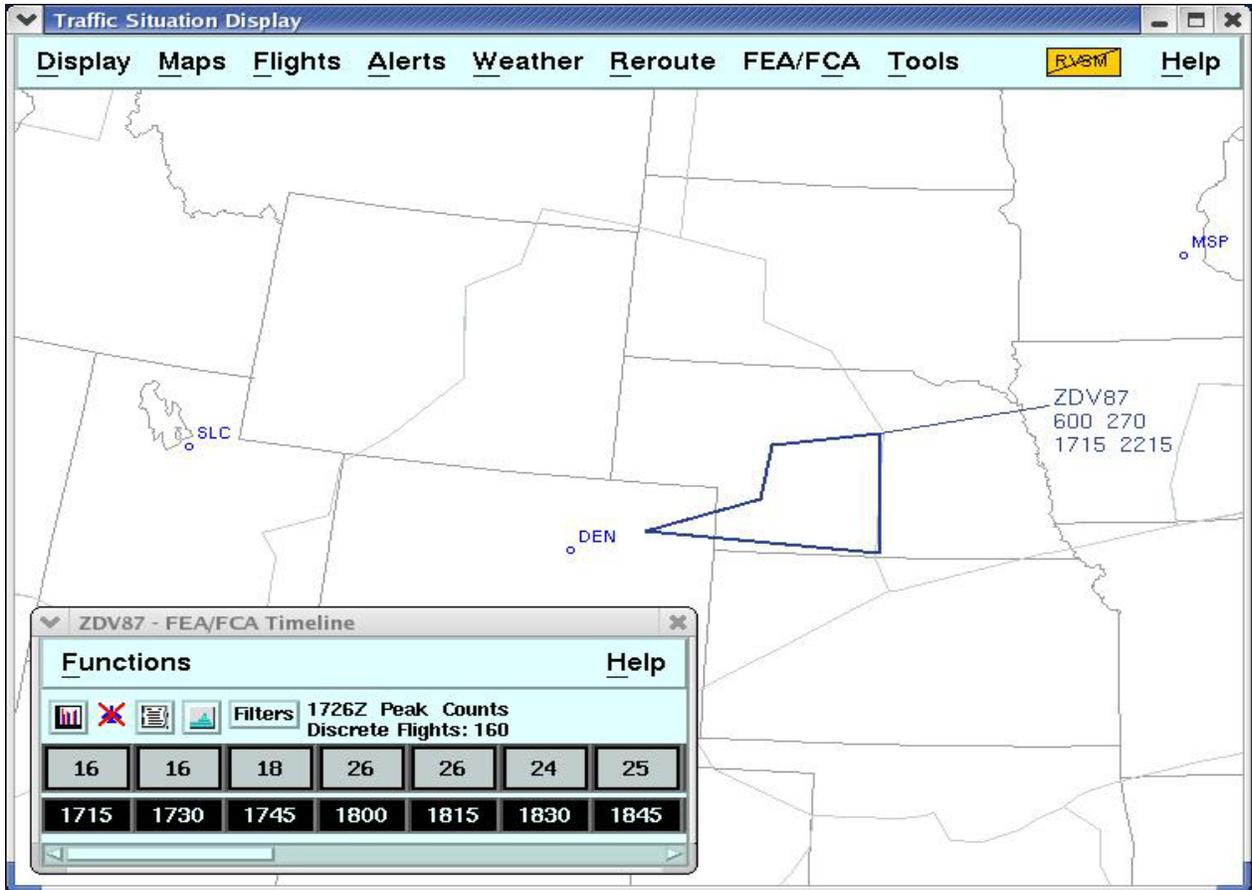


Figure 2-15. Example of Sector Proposal with traffic count timeline

## 2.5 Arrival/Departure Flow Management

FEAs have been used extensively to help monitor and manage arrival and departure flows. Previous examples discussed how ZTL uses FEAs filtered to monitor flights into smaller airports during special events. An example for Cleveland Hopkins airport (CLE) was briefly discussed above in Section 2.4 (e.g., see Figure 2-13). Other examples are discussed below.

### 2.5.1 Examples

#### ORD Arrival Flow Monitoring:

Figure 2-16 below shows FEAs built by ZOB to monitor arrival traffic into ORD. A TMC might determine from the FEA timeline data for the three arrival fixes that ZOB may have to take some initiative for the two northern flows, but not for the southernmost one. ZOB also reports they also create an FEA closer in to the ORD airport to determine the success of ‘blending’ these three arrival streams and others.

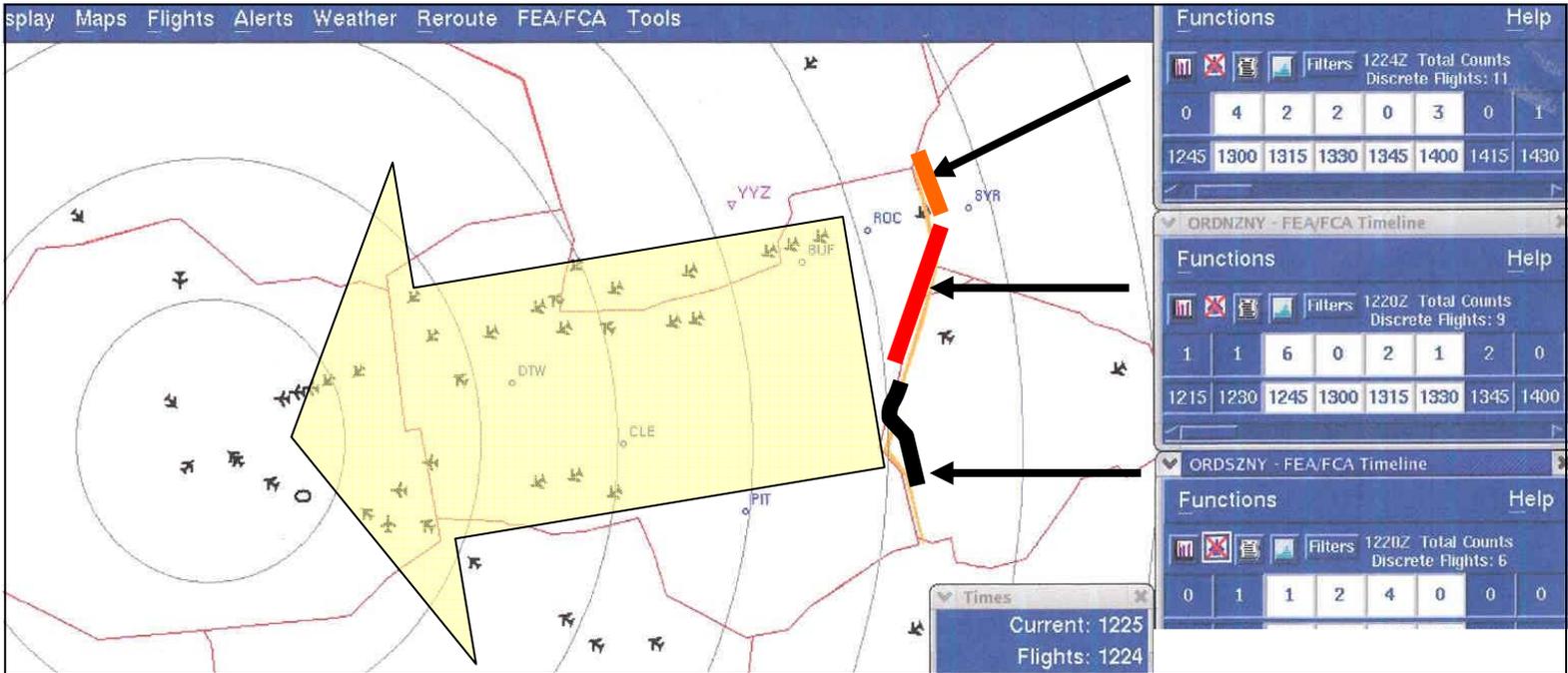


Figure 2-16. ZOB ORD Arrival Flow FEAs

Dynamic Sector Flow Monitoring for LAX Arrivals:

Traffic inbound from Mexico landing Los Angeles (LAX) can proceed via two different routes to the airport through two different arrival sectors. Both arrival sectors have the potential to become very busy and reach critical traffic levels. TMCs constantly monitor these sectors and route aircraft out of the busier sector.

Determining sector volume for these sectors is complicated by the fact that future volume includes departures that usually are not airborne when it is necessary to choose a route relative to sector volume. Setting up FEAs for both flows allows TMCs to compare projected sector volume, both airborne and scheduled, and determine which sector is a best fit for the arrival aircraft.

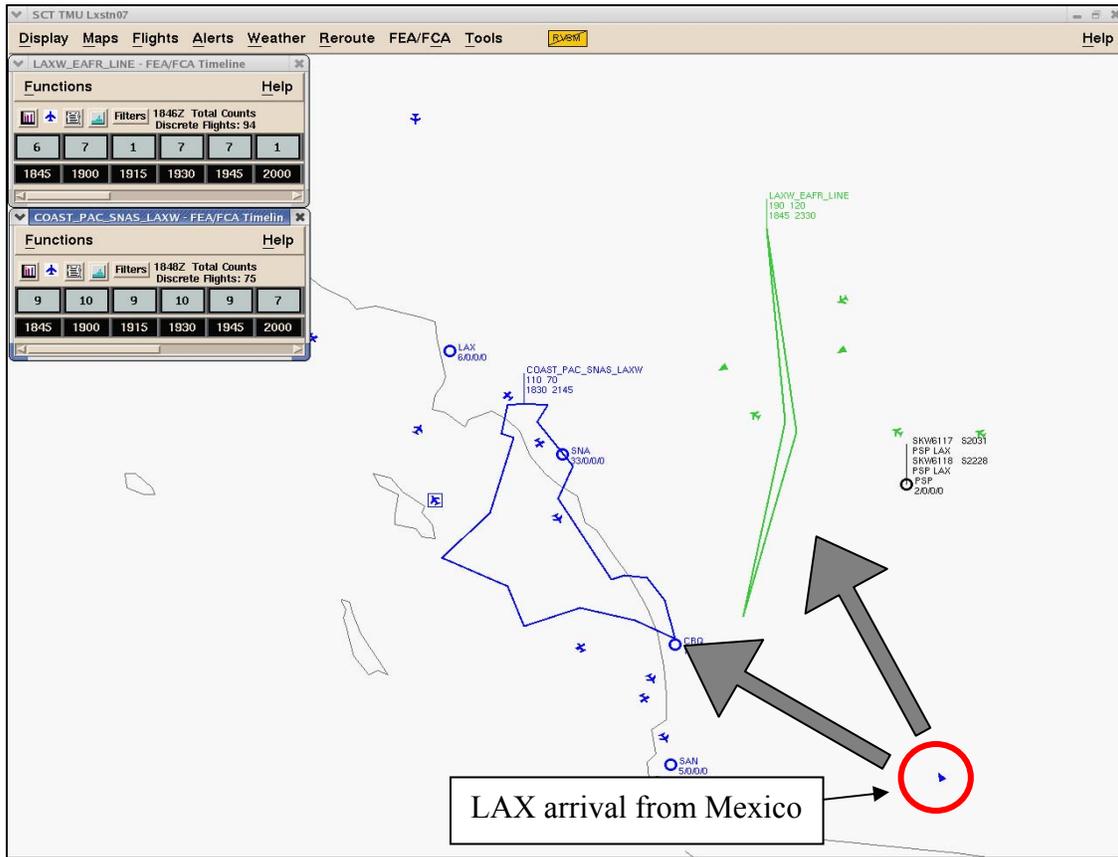


Figure 2-17. Two FEAs created to assist in real time route selection

FEAs for Arrival Flow Management Timing:

ZTL, ZFW and others report that FEAs allow them to see both the amount of arrival traffic and also specific times the flights will impact the traffic scenario over a specific area or fix. FEA entry time values help the TMU judge more precisely when traffic flow/volume might be an issue at arrival fixes or at the airport.

ZFW builds FEAs along their boundaries to monitor certain flows. When necessary, the TMU then shares the FEAs with the operational areas that control the flow of traffic to assist them in complying with playbook restrictions and in making adjustments to other flows to maintain a safe and orderly operation. The benefits of this sharing situational awareness can be extended to other facilities or even to Customers (through the ATCSCC) to promote further understanding, cooperation and collaborative problem solving.

Similarly, as seen in Figure 2-13 above, the FEA timeline details can give the ZOB TMU precise information for refining and narrowing the time period for a restriction. Using the FEA timeline (often in conjunction with Sector Monitor MAP values), the TMU can determine the precise 15-minute time buckets in which a sector or fix might have traffic volume issues. Using this information, the TMU can then determine exactly when action may be necessary and for how long.

FEA usage for sector ZFW86 – Arrivals and Departures:

The ZFW86 sector routinely exceeds the Monitor Alert Parameter due to a high volume of DFW arrivals, IAH/HOU departures, and over flights during different time periods. An FEA is used with sub-filters to color code these flows to help determine the time period and restrictions needed in traffic management initiatives to maintain an orderly flow of traffic. (See Figure 2-18 below.)

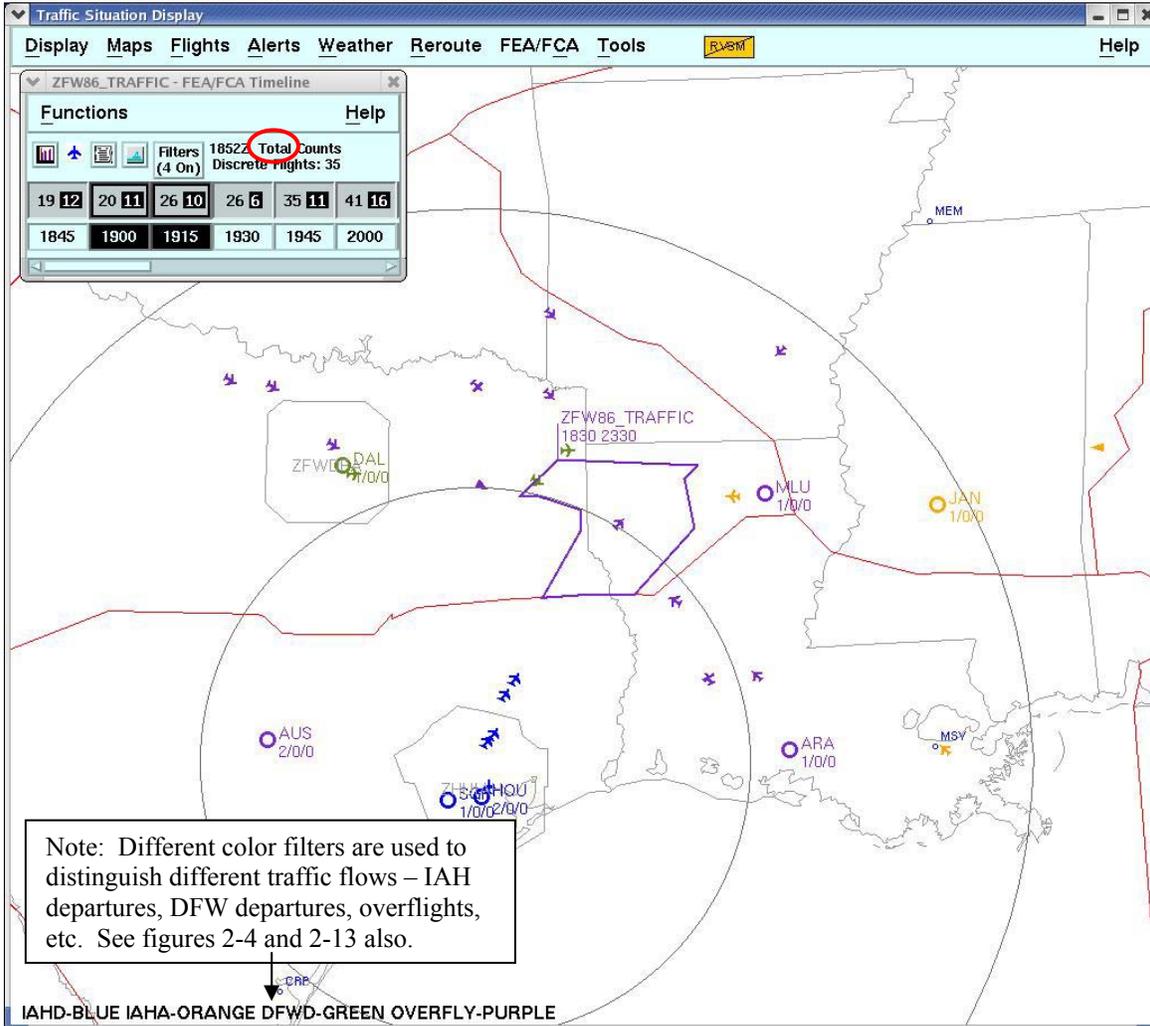


Figure 2-18. ZFW86 Example

Total and Peak Counts:

Notice that in Figure 2-18 the Timeline displays *Total Counts* as opposed to *Peak Counts* (see circled area at top).

FEA/FCA Timelines have the ability to show both Peak and Total counts. Timelines show traffic in 15 minute periods. *Total* counts show the number of aircraft that will be in the designated area for the 15 minute period. *Peak* counts show the highest number of aircraft that will be in the designated area at any one minute of time during the 15 minute period.

Figure 2-19 shows examples of Total and Peak Count Timelines. These came from the same single line FEA. The FEA shows the number of aircraft that will cross the line in each 15 minute period for the *Total*, and the maximum number that will cross the line in the busiest one minute segment of that 15-minute interval for the *Peak* Count. If Timeline numbers are not what you expected, it is worth checking to see which count type is displayed.

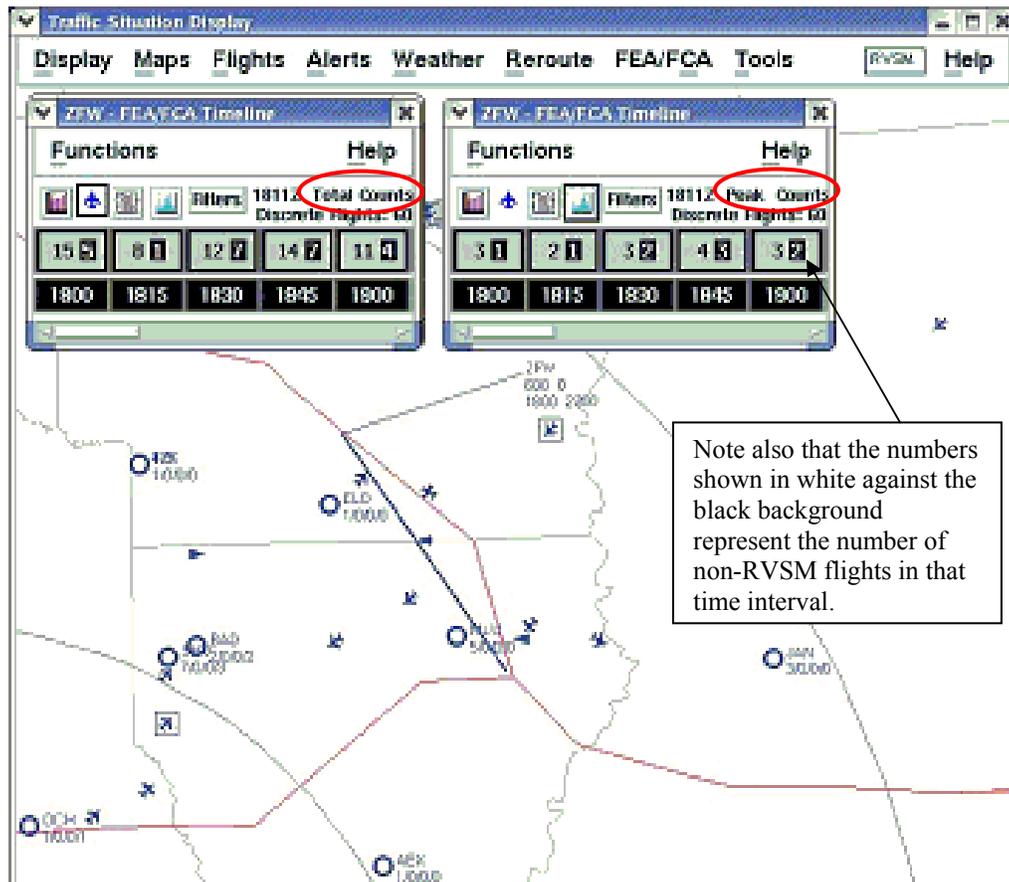


Figure 2-19. Total vs. Peak Count Example

FEAs for departure flow monitoring:

ZTL builds an FEA over departure gates for Atlanta (ATL) when traffic is running late due to Weather. The FEA data helps the TMU to gauge the remaining departure demand.

Several TMUs have also reported building FEAs to pull and share Lists with airlines (through the CCSD – see Figure 2-20) or with surrounding facilities to plan departure traffic flows during congested periods. Customers at a given airport could create FEAs when they know problems are likely to arise in a certain area (e.g., eastbound departures off a certain airport may become blocked by weather), and then share the FEA with ideas or offloads suggestions for the local air traffic facility.

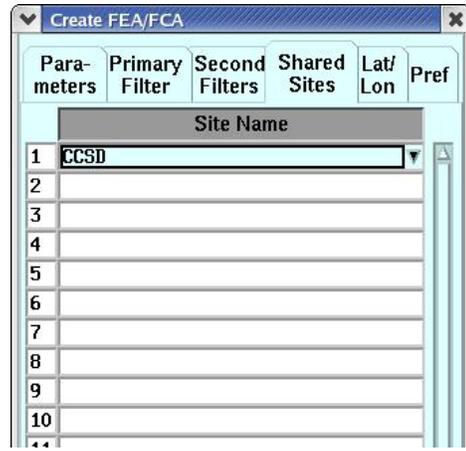


Figure 2-20. Sharing with Customers via CCSD

Although it is not shown in the CLE arrival picture previously shown above (Figure 2-13), ZOB reports they also create other FEAs for departure fixes to evaluate volume in sectors known for complexity due to crossing arrival and departure traffic.

FEAs used for total airport management picture:

Los Angeles Center TMU (ZLA) has an interesting method of using an FEA circle around the Las Vegas airport (LAS) to help develop a game plan for managing overall airport operations and capacity.

ZLA/LAS had a goal of reducing departure delays, especially on Sunday mornings and during special events that stress the system. They wanted to know how many total operations were taking place into and out of LAS in any given period. The criteria agreed to was that the Las Vegas Airport and Tracon (L30) could handle 105 operations (departures + arrivals) per hour under optimal conditions (68 rate, all runways available).

The thought process was to determine what the mix of arrivals and departures made up the total operations mix in any given 15-minute period.

They created an FEA circle around LAS (approximately 7 to 15 miles in diameter), which approximately captured the total operations filtered for landing at or taking off from LAS. This FEA showed the number (approximately) they were looking for. From this FEA, they created filtered FEAs; one that showed numbers of departures only, and one that showed numbers of arrivals only. So, at any given time they could see the total operations, along with the actual numbers of arrivals and departures that made up that number (a total of three FEAs). If the 15 minute total was above 26 (~105/4), and they determined that they wanted to curtail arrivals to allow more departures to leave, they could examine from where the arrivals were coming and take appropriate action to spread them out. They could also examine the departures and attempt to effect reroutes for one departure fix to free up other departure routes.

Monitoring arrival or departure fixes on CCSD:

Flight Operations Center (FOC) personnel use CCSD to build and monitor FEAs. Here is an example of how they might use FEAs to help manage their arrival or departure flows.

Frequently, during peak arrival times, arrival fixes may exceed capacity resulting in airborne holding, metering delays, or aircraft offloading for fix balancing. Departure fixes could also experience similar constraints during peak departure times, possibly resulting in “out-off” delays. There are also instances in which fixes may become “shut off” due to weather. By creating an FEA, it is possible for an Airline Operations Center (AOC) to identify flights that may be affected. If done in advance, this information could be passed onto the affected dispatchers for planning purposes. They may elect to add extra fuel for holding or metering, or add a secondary flight plan for a possible offload to another fix. As an example, Figure 2-21 shows an FEA built by an airline to monitor flights over the Eau Claire (MSP) arrival fix into MSP.

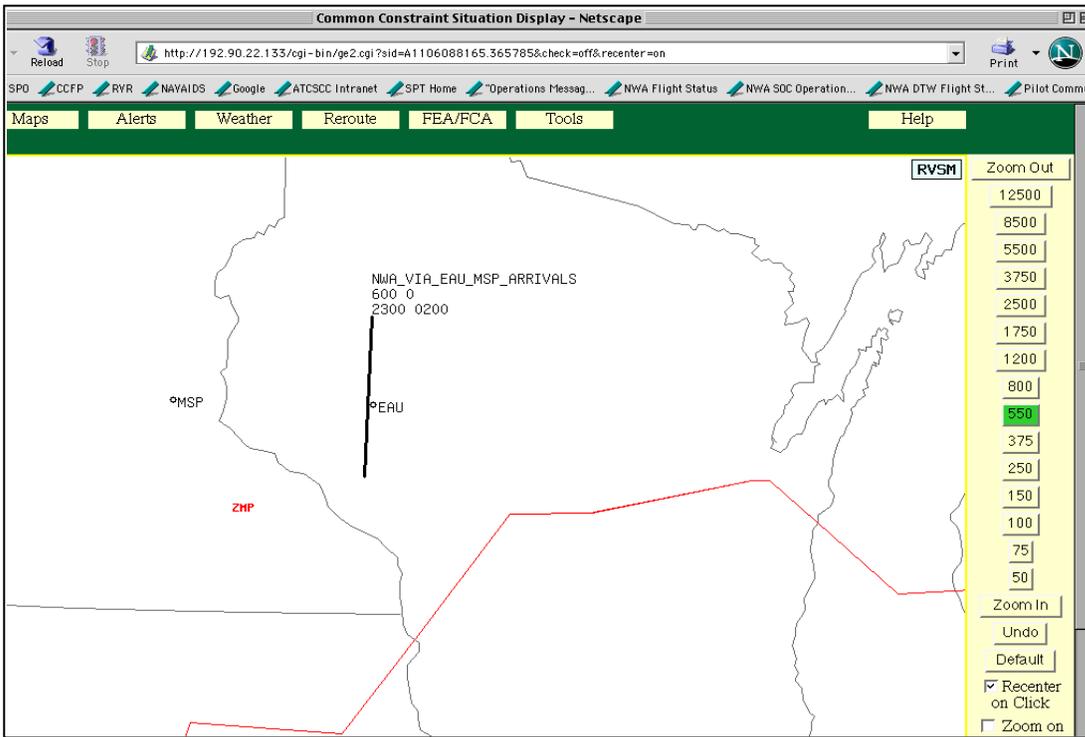


Figure 2-21. CCSD shot of an FEA created to monitor MSP arrivals over EAU

After the EAU FEA is built, the flight dispatcher can monitor lists for its specific flights that arrive over that fix. The next figure, 2-22, shows a CCSD FEA Dynamic Flight List of a specific airline’s flights that will arrive MSP via the EAU arrival. (Note: A bug is causing the ‘Dep Center’ information to be incorrectly displayed in this figure.)

Rownum	ACID	RVSM	Status	Entry Time	Exit Time	Top Alt	Dep Airport	Dep Device	Estimated Dep	Aircraft Type	Speed	FMS	Altitude	Other
1	N7941		P	0200	0200	3500	MSP	DLA	0200	DLA	400	310		MSP-EAU-BATT-MSP-DC
2	N7942		K	0200	0200	3500	MSP	DLA	0200	DLA	400	310		MSP-EAU-BATT-MSP-DC
3	N7943		P	0200	0200	3500	MSP	DLA	0200	DLA	400	310		MSP-EAU-BATT-MSP-DC
4	N7944		P	0200	0200	3500	MSP	DLA	0200	DLA	400	310		MSP-EAU-BATT-MSP-DC
5	N7945		P	0200	0200	3500	MSP	DLA	0200	DLA	400	310		MSP-EAU-BATT-MSP-DC
6	N7946		P	0200	0200	3500	MSP	DLA	0200	DLA	400	310		MSP-EAU-BATT-MSP-DC
7	N7947		P	0200	0200	3500	MSP	DLA	0200	DLA	400	310		MSP-EAU-BATT-MSP-DC
8	N7948		P	0200	0200	3500	MSP	DLA	0200	DLA	400	310		MSP-EAU-BATT-MSP-DC
9	N7949		P	0200	0200	3500	MSP	DLA	0200	DLA	400	310		MSP-EAU-BATT-MSP-DC
10	N7950		P	0200	0200	3500	MSP	DLA	0200	DLA	400	310		MSP-EAU-BATT-MSP-DC
11	N7951		P	0200	0200	3500	MSP	DLA	0200	DLA	400	310		MSP-EAU-BATT-MSP-DC
12	N7952		P	0200	0200	3500	MSP	DLA	0200	DLA	400	310		MSP-EAU-BATT-MSP-DC
13	N7953		P	0200	0200	3500	MSP	DLA	0200	DLA	400	310		MSP-EAU-BATT-MSP-DC
14	N7954		P	0200	0200	3500	MSP	DLA	0200	DLA	400	310		MSP-EAU-BATT-MSP-DC
15	N7955		P	0200	0200	3500	MSP	DLA	0200	DLA	400	310		MSP-EAU-BATT-MSP-DC
16	N7956		P	0200	0200	3500	MSP	DLA	0200	DLA	400	310		MSP-EAU-BATT-MSP-DC
17	N7957		P	0200	0200	3500	MSP	DLA	0200	DLA	400	310		MSP-EAU-BATT-MSP-DC
18	N7958		P	0200	0200	3500	MSP	DLA	0200	DLA	400	310		MSP-EAU-BATT-MSP-DC
19	N7959		P	0200	0200	3500	MSP	DLA	0200	DLA	400	310		MSP-EAU-BATT-MSP-DC
20	N7960		P	0200	0200	3500	MSP	DLA	0200	DLA	400	310		MSP-EAU-BATT-MSP-DC
21	N7961		P	0200	0200	3500	MSP	DLA	0200	DLA	400	310		MSP-EAU-BATT-MSP-DC
22	N7962		P	0200	0200	3500	MSP	DLA	0200	DLA	400	310		MSP-EAU-BATT-MSP-DC
23	N7963		P	0200	0200	3500	MSP	DLA	0200	DLA	400	310		MSP-EAU-BATT-MSP-DC
24	N7964		P	0200	0200	3500	MSP	DLA	0200	DLA	400	310		MSP-EAU-BATT-MSP-DC
25	N7965		P	0200	0200	3500	MSP	DLA	0200	DLA	400	310		MSP-EAU-BATT-MSP-DC
26	N7966		P	0200	0200	3500	MSP	DLA	0200	DLA	400	310		MSP-EAU-BATT-MSP-DC
27	N7967		P	0200	0200	3500	MSP	DLA	0200	DLA	400	310		MSP-EAU-BATT-MSP-DC
28	N7968		P	0200	0200	3500	MSP	DLA	0200	DLA	400	310		MSP-EAU-BATT-MSP-DC
29	N7969		P	0200	0200	3500	MSP	DLA	0200	DLA	400	310		MSP-EAU-BATT-MSP-DC
30	N7970		P	0200	0200	3500	MSP	DLA	0200	DLA	400	310		MSP-EAU-BATT-MSP-DC

Figure 2-22. CCSD List of one airline’s flights arriving MSP via the EAU arrival

The next figure (2-23) shows total counts of ALL aircraft in 15-minute increments when the FEA was examined. This helps make the AOC aware of where and when problems might arise. If they see counts above the MAP values or a flurry of arrivals at the same time interval, they would know action like a reroute or offloading to another arrival fix is likely. They might then proactively work to resolve the problem before restrictions are imposed.

Time	Total Counts
0115	7
0130	5
0145	5
0200	2
0215	2
0230	2
0245	6
0300	0

Figure 2-23. CCSD Timeline counts of arrival traffic over EAU

*Operator use of FEAs for departure monitoring at EWR:*

Another airline reports building an FEA around the NY metro area to monitor counts at all the departure gates for flights off of Newark (EWR). If they see potential problems due to volume or weather, they can then be proactive with fueling or routing alternatives.

## 2.6 Military Special Use Airspace Management

Several TMUs are now experimenting with FEAs to help more efficiently manage some Special Use Airspace (SUA) usually reserved for military training activity. This is done by selecting a Military Operating Area (MOA) as a “NAS Element” for the FEA. Increased access to some Military airspace when not in use by the Department of Defense (DoD) offers many levels of benefits to Customers, including more flexibility in planning and operating flights to meet specific objectives of airspace users.

### 2.6.1 Examples

ZMP, ZKC, ZAB (Albuquerque Center TMU) and others are currently using FEAs to designate and evaluate some military training areas.

#### ZMP Example:

ZMP works with the Air National Guard Airspace Schedulers when high altitude blocks are requested. In the example shown in Figure 2-24 below, ZMP might request the unit avoid the airspace during certain time frames to minimize impact on other NAS Customers.

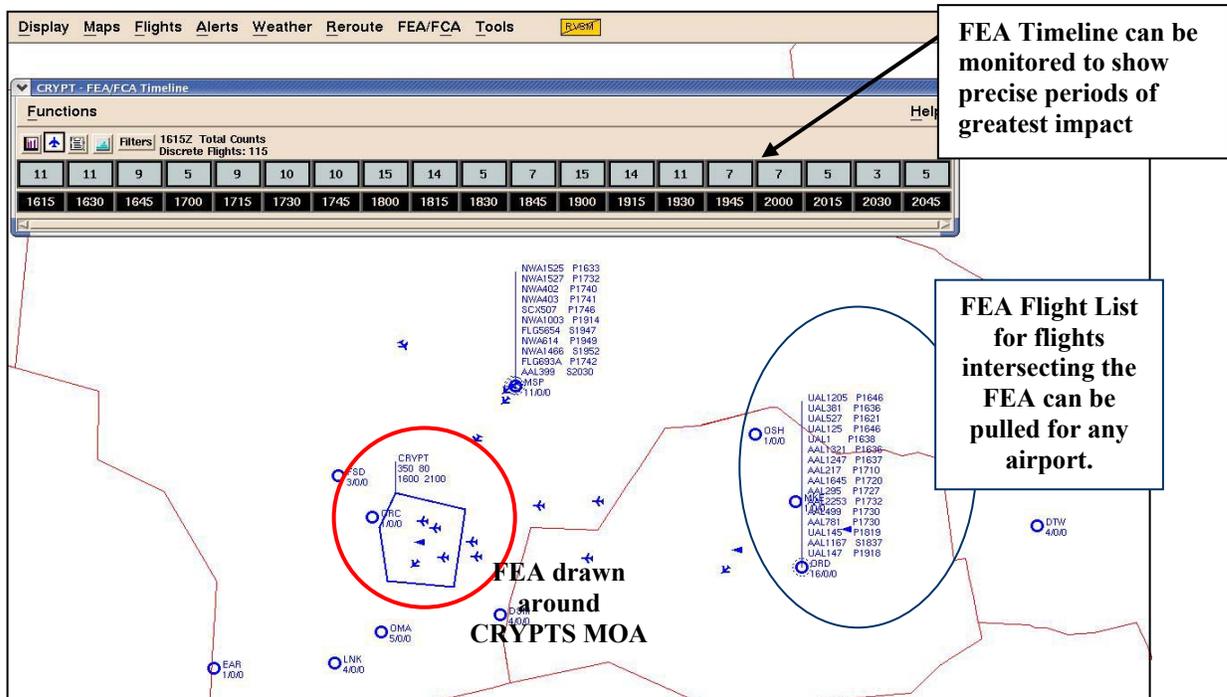


Figure 2-24. FEA around Crypts MOA

#### ZAB Example:

ZAB also uses FEAs extensively for managing MOAs. They build and share FEAs from MOAs as NAS Elements, and use these MOA FEAs to schedule and plan more ‘dynamically.’ They use the FEAs to help conduct planning Telcons with the military regarding schedules, especially during SWAP season. The FEAs help determine the number of flights affected by MOA activity so they can then adjust MOA

altitudes/times when necessary. These Military FEAs are saved and then re-filtered with times/altitudes as needed.

MOA, Restricted, Warning, and Prohibited area monitoring on CCSD:

NAS Customers can build and/or monitor FEAs for MOAs from CCSD. By creating FEAs around active SUA areas, FOCs can potentially monitor FEAs to determine when areas normally closed may be open and available. If FOC personnel know of an active SUA and its active time and altitudes, they can draw an FEA around the area to monitor flights that are affected.

In the “Maps” menu select “Overlays” to display MOAs, Prohibited, Restricted and Warning Areas. An FEA can then be created over the SUA.

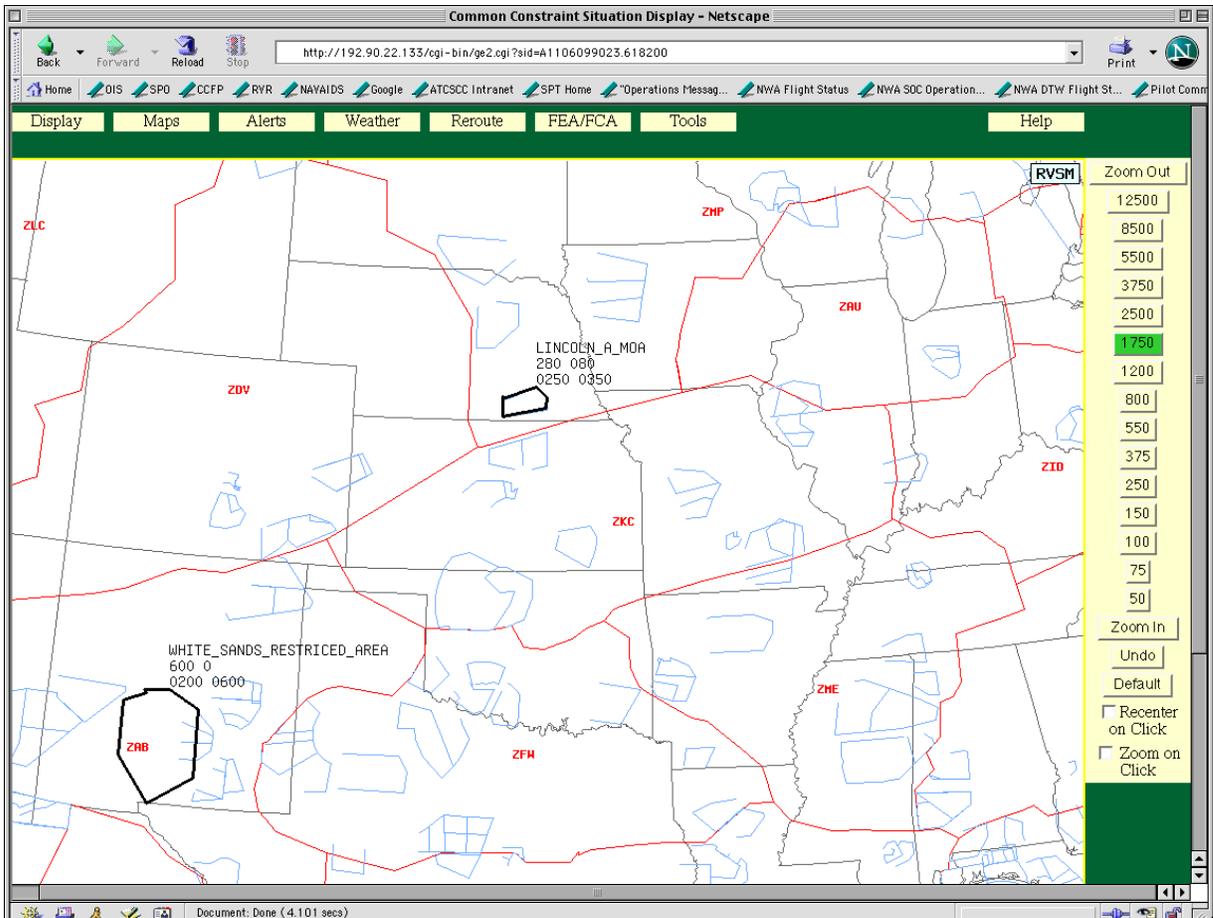


Figure 2-25. FEAs created with CCSD for active MOA and Restricted area



FEAs for Ski Country Traffic:

FEAs/FCAs have also been used to help manage ski country traffic flows in the winter. Large numbers of general aviation aircraft fly into small ski resort airports creating heavy traffic flows in areas and airports not generally conducive to handling the sudden surge in traffic. The ATCSCC has created a generic ski-country FEA with Playbook Routes loaded in that captures a general picture of the number of flights inbound to the ZDV ski areas and which ones might be on inappropriate routes. The ZDV TMU may manipulate this generic FEA slightly, and may also create FEAs on their borders. This allows them to determine boundary crossing times for MIT or crossing altitude restrictions.

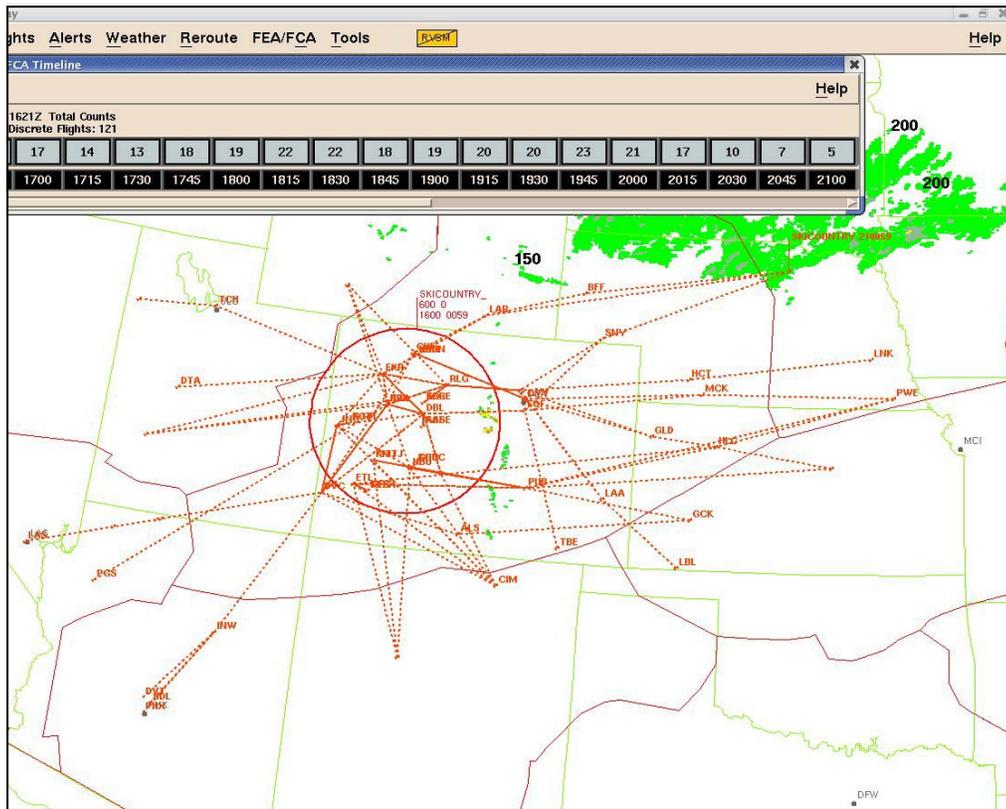


Figure 2-27. FEA used to help manage Ski-Country traffic.

FEAs used for special events such as Sporting Events or 'Fly-ins':

ZTL reports that they use FEAs to help them monitor and manage traffic inbound to small airports for the Masters Golf Tournament or NASCAR Race events. They can filter for traffic inbound to smaller airports near event sites and determine if traffic management actions are necessary.

They also have an interesting practice for managing departures from within their Center outbound to NASCAR events. They already know where the base airports are for many NASCAR participants. So they put up a filter at their Center boundary and filter for aircraft departing those base airports to get some advance warning of when the flow of flights to the next scheduled NASCAR event will occur.

The FEA ADVZY shown below illustrates the use of a Public FEA to promote common awareness regarding the Masters Golf Tournament traffic constraints in April 2004.

**ATCSCC Advisory**

**ATCSCC ADVZY 012 DCC 04/08/04 ROUTE ADVISORY FEA\_MASTERS\_DCC\_PLN**

RAW TEXT: **ATCSCC ADVZY 012 DCC 04/08/04 ROUTE ADVISORY FEA\_MASTERS\_DCC\_PLN**  
**IMPACTED AREA: ZTL/ZJX - LNDNG AGS/DNL/AIK/HQU**  
**REASON: MASTERS GOLF TOURNAMENT**  
**FACILITIES INCLUDED: ALL**  
**VALID: FEA ENTRY 081100 TO 090159**  
**PROBABILITY OF EXTENSION: DAILY THROUGH 04/12/04**

**REMARKS: THIS FEA IS BEING MADE AVAILABLE TO ALL NAS USERS TO PROVIDE COMMON SITUATIONAL AWARENESS REGARDING TRAFFIC VOLUME TO THE FOUR AIRPORTS INCLUDED IN THE MASTERS SPECIAL TRAFFIC MANAGEMENT PROGRAM.**

**ASSOCIATED RESTRICTIONS: ROUTE RESTRICTIONS ARE IN PLACE FOR ALL TRAFFIC LANDING AGS/DNL/AIK/HQU. SEE THE SPECIAL AIR TRAFFIC PROCEDURES CONTAINED IN THE NOTICES TO AIRMEN.**

**081100-090200**

**04/04/08 11:39**

Figure 2-28. FEA ADVZY used to help manage Masters Golf traffic

ZMP and ZAU create temporary sectors each year to support the Oshkosh Experimental Aircraft Association (EAA) Fly-In Convention. Building FEAs can replace the Monitor Alert functionality for these temporary sectors that are not currently recognized by ETMS, and helps TMUs monitor and evaluate the traffic flows into the area.

FEAs to manage equipment-related issues:

FEAs or FCAs have also been successfully used to help monitor and manage traffic around equipment outages; see the ADVZY below. Although there is no reference to the FEA, the ADVZY shown below in Figure 2-29 was evaluated with a Public FEA prior to being issued. The traffic count in the FEA List indicated there was sufficient reason to initiate a MIT restriction on J42. Everyone was able to review and understand the rationale (FEA Dynamic List) prior to the restriction being implemented.

**ATCSCC Advisory**

**ATCSCC ADVZY 038 DCC 04/19/04 ROUTE ADVISORY DFW EAST (LIT) DEPARTURES \_ RQD**

RAW TEXT: ATCSCC ADVZY 038 DCC 04/19/04 ROUTE ADVISORY DFW EAST (LIT) DEPARTURES \_ RQD  
IMPACTED AREA: ZME20/ZME21  
REASON: FREQUENCY OUTAGE  
INCLUDE TRAFFIC: DFW DEPARTURES FILED OVER LIT  
FACILITIES INCLUDED: ZFW/ZME  
VALID: PTIMES THROUGH 0000Z  
PROBABILITY OF EXTENSION: MODERATE  
REMARKS: SVRWX/GH  
ASSOCIATED RESTRICTIONS: J42 DEPARTURES, 10 MIT AS ONE  
ROUTE(S):

FROM:

ORIG	DEST	ROUTE
----	----	-----
DFW	<u>FILED OVER LIT</u>	<u>VIA ... TTK J42 MEM ... ON COURSE</u>

191828-200000  
04/04/19 18:31

Figure 2-29. FEA ADVZY for equipment outage

## **Summary**

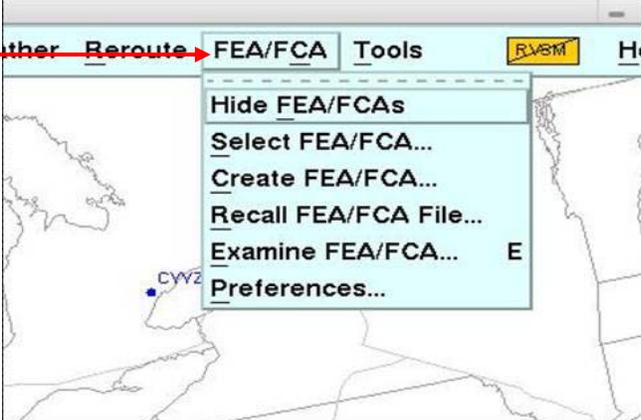
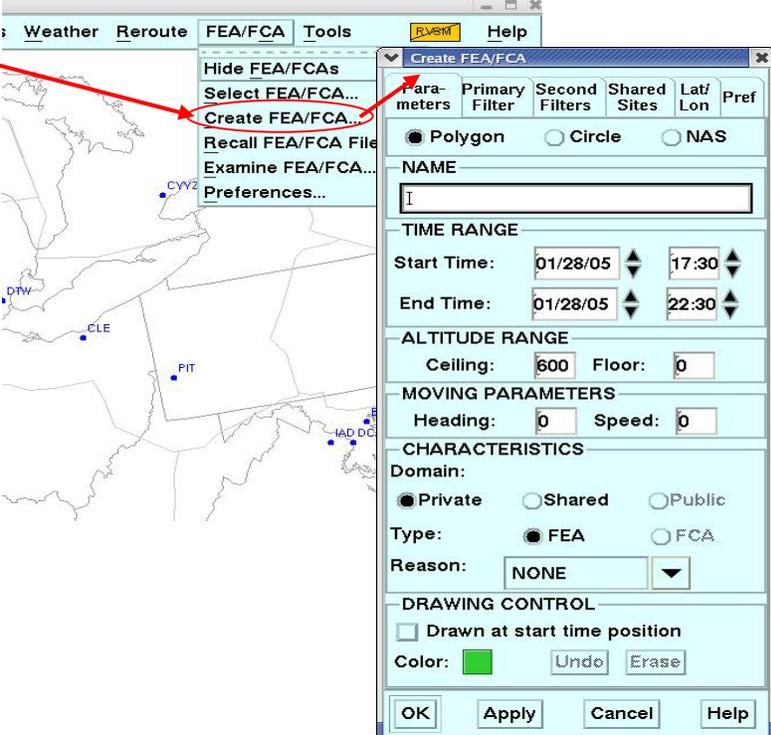
The FEA/FCA tool was designed to benefit the National Airspace System (NAS) by enhancing the quality of information used to evaluate flow decisions. The tool and associated processes enable FAA facilities and NAS customers to evaluate additional options to traffic flow and volume situations when capacity is limited. FAA facilities can derive effective traffic management solutions by evaluating flow areas, sharing the information with affected stakeholders, and then collaborating on a traffic management mitigation strategy. It is envisioned that with expanded use of the FEA/FCA tool by all participants, the overall National Airspace System will perform more effectively.

## Appendix A — Basic Instructions for Using FEAs

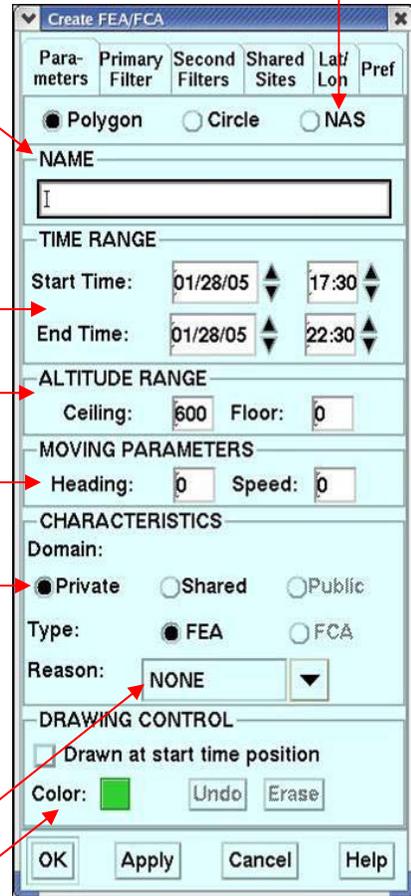
This section describes basic user methods for how to use the FEA/FCA tool; that is, how to build and manage FEAs and FCAs. Three basic topics are covered at the request of many tool users: How to build an FEA, how to filter FEAs, and how to save FEAs for future use.

### Appendix A – 1: How to Build an FEA/FCA

#### Building an FEA/FCA with TSD:

STEPS	DESCRIPTION
<p>STEP 1:</p> <p>Select &lt; FEA/FCA &gt; from TSD Header Bar</p>	
<p>STEP 2:</p> <p>Select &lt; Create FEA/FCA &gt; from the drop down menu.</p> <p>This opens a “Create FEA/FCA” Dialog Box.</p> <p>NOTE: Alternatively, right click on the TSD offers “Create FEA/FCA” as an option.</p> 	

<p>STEP 3: <u>Define the desired FEA/FCA Parameters from the FEA/FCA Dialog Box.</u></p>	<p>Select whether you want to draw a <u>Polygon</u> (line, box, triangle, etc.) or a <u>Circle</u>, or whether you want to create an FEA/FCA from a <u>NAS element</u></p> <p>Type in a <u>NAME</u> for the FEA you will build.</p> <ul style="list-style-type: none"> <li>- Select a short, descriptive name that will help if the FEA is shared.</li> <li>- FCAs will be automatically named with label “FCA” and then 3 digit number (e.g., FCA002)</li> </ul> <p>Enter <u>Start</u> and <u>End</u> Time for your FEA/FCA.</p> <p>Enter the <u>ALTITUDE RANGE</u> for your FEA/FCA.</p> <p>Enter <u>Moving Parameters</u> if your FEA/FCA will be moving.</p> <p>Enter a <u>Domain</u> information for your FEA/FCA; choices are:</p> <ul style="list-style-type: none"> <li>- Private: for your own use only</li> <li>- Shared: to explicitly share with another TMU</li> <li>- Public: (ATCSCC only) to share with all TSD/CCSD users</li> </ul> <p><u>Type</u>: will be preset as FEA unless you are an ATCSCC user.</p> <p>Select a “<u>Reason</u>:” from the drop down list.</p> <p>Select a “<u>Color</u>:” for the FEA/FCA you will draw.</p> <ul style="list-style-type: none"> <li>- Use caution if sharing; make it an easily viewable color.</li> </ul> <p><u>Undo</u> will delete the last line drawn.</p> <p><u>Erase</u> will erase the entire drawn FEA/FCA.</p>
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STEP 4:

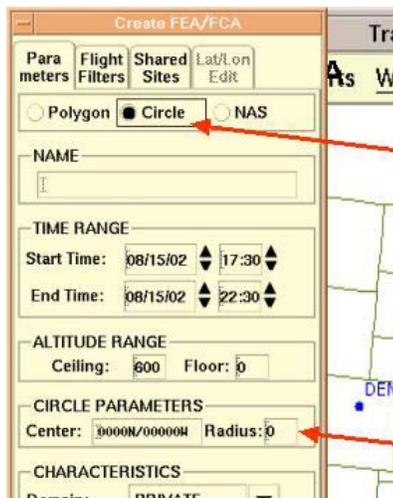
Draw the FEA/FCA you have defined.

● Polygon

- Click at least 2 points on the TSD
  - 2 = a Line FEA or FCA
  - 3 or more for a desired polygon shape
  - Or click and drag to create desired shape
- Click “OK” at the bottom of the “Create FEA/FCA” Dialog Box.

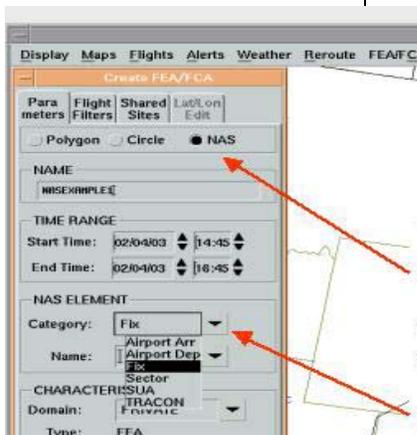
● Circle

- Click and drag on the TSD, or ...
- Define in the “Circle Parameters” block that will appear when you select < Circle >
  - Enter LAT/LONG of the Center and then enter the Radius length desired.



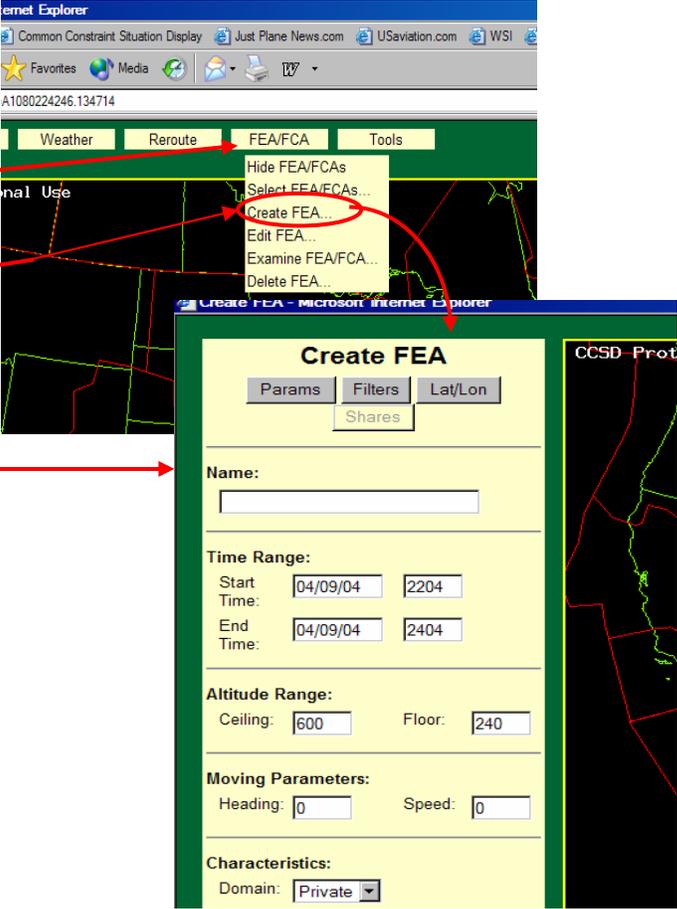
● NAS

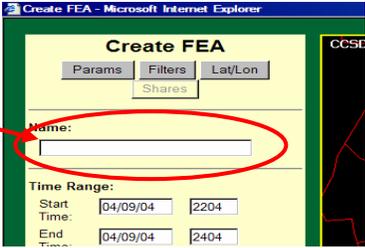
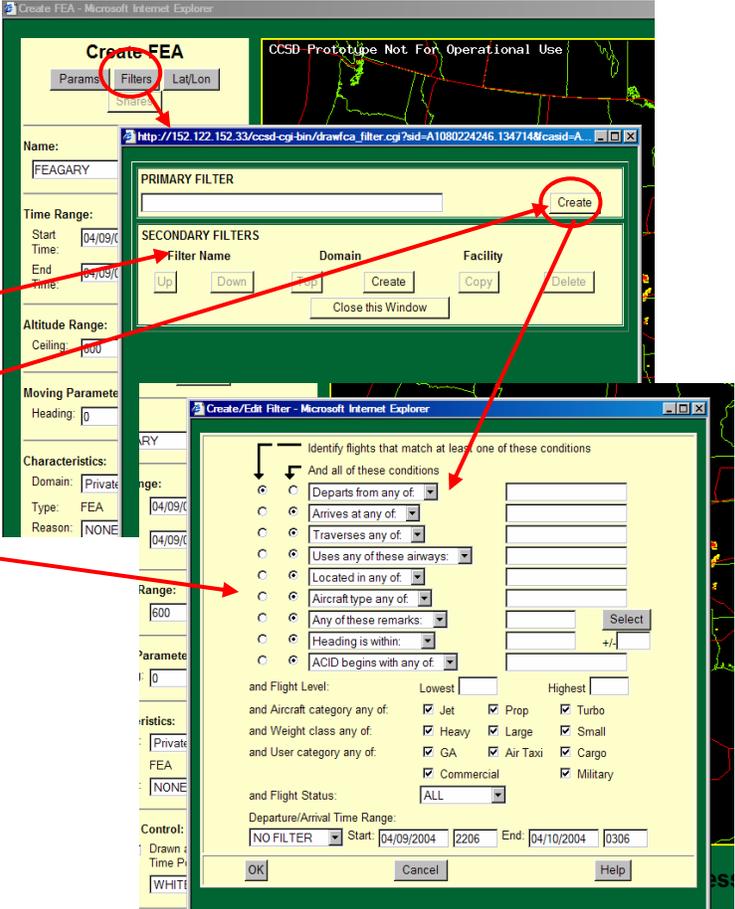
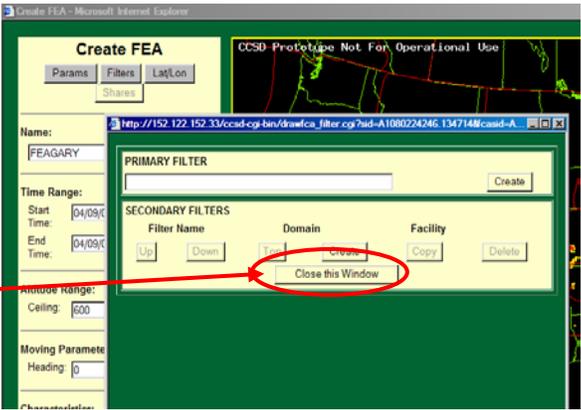
- Select the type of NAS element for which you want to create an FEA/FCA from the “Category:” drop down menu (e.g., Fix, TRACON, Sector, SUA, etc.)
- Then, select the “Name” of the element you want from the drop down that will appear
- Or, type in the name of the specific NAS element that you want to serve as your FEA/FCA.



<p><b>STEP 5:</b></p> <p>From the Create FEA/FCA Dialog Box, <u>apply the FEA</u> or FCA you have created.</p> <p>Press &lt; <b>OK</b> &gt; to apply the function and close the dialog box.</p> <p>Press &lt; <b>Apply</b> &gt; to apply the function and allow the box to remain open.</p>	
---	--

### Building an FEA with CCSD:

STEPS	DESCRIPTION
<p><b>STEP 1:</b></p> <p><u>Open the Create FEA/FCA function on the CCSD.</u></p> <p>Select &lt; <b>FEA/FCA</b> &gt; from the top of the CCSD.</p> <p>Then click on &lt; <b>Create FEA/FCAs</b> &gt; from the drop down menu that appears.</p> <p>A “Create FEA” Dialog Box will open.</p>	

<p>STEP2:</p> <p><u>Name</u> your FEA.</p> <p>Note: Do not use “CA” in the name.</p>	
<p>STEP 3:</p> <p><u>Create Filters</u> to select flows or flights pertinent to your FEA.</p> <p>Click on &lt; <b>Filters</b> &gt; at the top of the Create FEA Dialog Box.</p> <p>This opens a Primary and Secondary Filter Dialog Box.</p> <p>Next, Click on the &lt; <b>Create</b> &gt; button to open a Create/Edit Filter Dialog Box.</p> <p>Then create filters in the same manner as with the TSD (described below in Appendix 1 - 2); that is, using radio buttons plus Arrivals/Departures and other filters desired for your FEA.</p>	
<p>STEP 5:</p> <p><u>Save the FEA Information and Close the Filter Box.</u></p> <p>Click &lt; <b>OK</b> &gt; button to save the FEA information.</p> <p>Then Click &lt; <b>Close the Window</b> &gt; on the Primary and Secondary Filter Dialog Box.</p>	

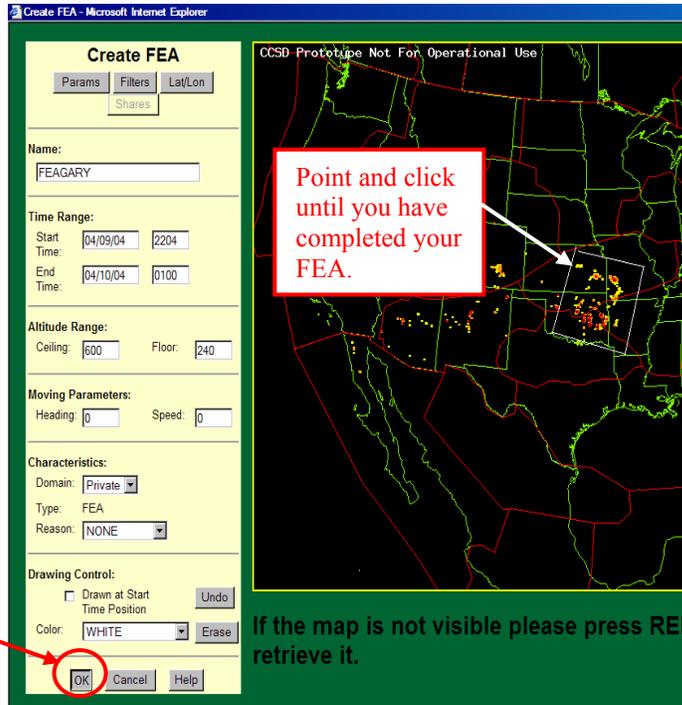
STEP 6:

Draw and save the FEA.

Draw the FEA on the CCSD using point and click steps until you have completed the FEA.

Then Click < **OK** > at the bottom of the Create FEA box to save the FEA.

You will receive a Confirmation box, which you subsequently < Close >.



## Appendix A – 2: How to Filter an FEA/FCA

### Using Primary and Secondary Filters:

The filtering options available for FEAs/FCAs provide ATC/traffic managers and flight dispatchers with a powerful tool for displaying selected traffic. By combining Primary and Secondary filters, displays can be created that show traffic information for almost any situation.

How to set up filters is detailed in FEA/FCA Training material. However, the best way to show this capability might be to provide an example of how filters can be applied in a traffic management scenario.

The following example is based on Houston Intercontinental TRACON (I90). It shows how to set up an FEA to be saved that would give quick access to traffic information for each departure gate.

First an FEA is created using I90's airspace as the basis. This is accomplished by selecting NAS Element as the type of FEA to be created and changing the Category to TRACON with a Name of ZHUJIAH (this is the ETMS name for I90).

Next, use the Primary Filters Tab to select the airports, times, and other filters you want to apply in the FEA you are building.

Use a NAS Element with ZHUJIAH as the element

The primary filter could include selected airports

To exclude any arrivals, set Departure/Arrival Time Range to Departure and the time to correspond with the FEA time.

**Semi-important Note:** If only IAH and HOU departures were needed, IAH and HOU would be entered in the **Departs from any of:** line. If IAH and HOU were to be excluded, click the down arrow button at the end of that line to change the choice to **Departs from none of:**.

**Very Important Note:** If a Secondary Filter is to be used, the Primary filter must encompass the traffic to be displayed in the Secondary Filter. Traffic not included in the Primary Filter cannot be displayed by the Secondary Filter.

Secondary filters would then be created for each Departure Gate. The Departure fixes that correspond with the gate would be entered in the **Traverses any of:** line.

Each gate would have a Secondary Filter with the departure fixes listed in the **Traverses any of:** line

	Show	Filter Name	Color	Domain	Facility
1	<input type="checkbox"/>	CLEEP	Yellow	PRIVATE	okc
2	<input type="checkbox"/>	INDUSTRY	Blue	PRIVATE	okc
3	<input type="checkbox"/>	LEDNA	Orange	PRIVATE	okc
4	<input type="checkbox"/>	PSX	Green	PRIVATE	okc
5	<input type="checkbox"/>	TRIOS	Pink	PRIVATE	okc

Residual Flights

Up Down Top Copy Delete

OK Apply Cancel Help

Name: CLEEP Color: Yellow

Domain:  Private  Shared  Public

Create a Subset of flights that match the primary filter and at least one of these conditions  
And all of these conditions

OR AND

Departs from any of: [ ]

Arrives at any of: [ ]

Traverses any of: GIFFA LFK

Uses any of these airways: [ ]

Located in any of: [ ]

Aircraft type any of: [ ]

Any of these remarks: [ ] Select

Heading is within: [ ] +/- [ ]

ACID begins with any of: [ ]

and Flight level: Lowest 0 Highest 600

and Aircraft category any of:  Jet  Prop  Turbo

and Weight class any of:  Heavy  Large  Small

and User category any of:  GA  Air Taxi  Cargo

Commercial  Military

and Flight Status: ALL [ ]

and RVSM Status:  All  Compliant  Non-compliant

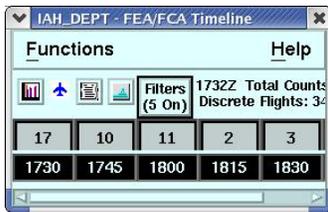
Departure/Arrival Time Range  
NO FILTER [ ] Start 01/12/05 17:30 End 01/12/05 22:30

Primary Filter Summary

Secondary Filter Summary (Subset of Primary)  
[TRAVERSE: (GIFFA OR LFK)]

OK Cancel Help

Examining the FEA would bring up a timeline that shows the number of flights proposed to depart all of the airports in the I90 airspace for the time range selected. From that timeline a Dynamic List could be displayed that show the route of flights for the selected filter(s).



IAH\_DEPT - FEA/FCA Dynamic List

File Functions Help

Hold Filters (1 On) Current Time : 1659 Active : 0  
Updated At : 1655 Inactive : 16  
Total : 16

ACID	ETD	ENTRY	ABBR ROUTE
BTA2191	P1712	1712	IAH-LFK4.LFK-SDF
COA674	P1706	1706	IAH-LFK4.LFK-ORD
BTA3242	P1702	1702	IAH-LFK4.LFK-MKE
BTA7893	P1707	1707	IAH-LFK4.LFK-MEM
CHO7675	P1751	1751	IAH-LFK4.LFK-IAD
COA358	P1709	1709	IAH-LFK4.LFK-DCA
DAL1636	P1759	1759	IAH-LFK4.LFK-CVG
BTA2039	P1702	1702	IAH-LFK4.LFK-CHH
BTA2652	P1707	1707	IAH-LFK4.LFK-BNA
COA1526	P1714	1714	IAH-LFK4.LFK-BDL
BTA2523	P1702	1702	IAH-GIFFA1.GIFFA-DFW
AAL1238	P1709	1709	IAH-GIFFA1.GIFFA-DFW
CAA151	P1722	1722	IAH-GIFFA1.GIFFA-DFW
SUA286	P1709	1709	HOU-LFK4.LFK-BNA
N6114A	P1738	1738	HOU-LFK4.LFK-5AR1
N335UH	P1740	1740	CXO-REX2.REX-OCF

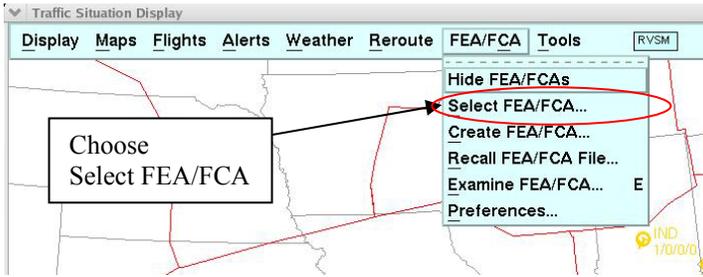
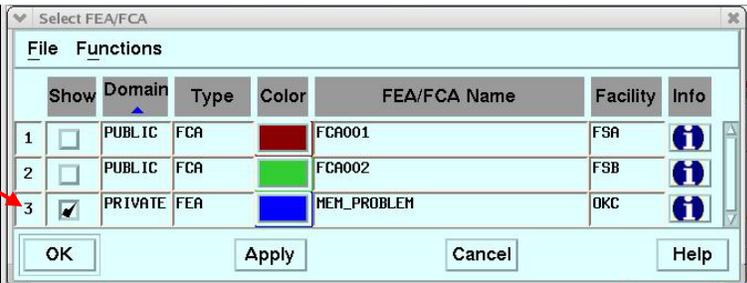
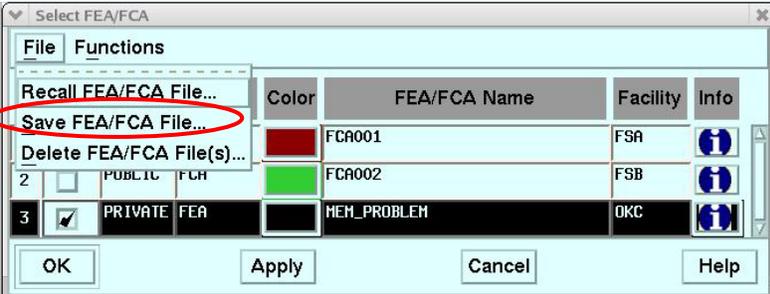
## Appendix A - 3: How to Save and Recall an FEA/FCA

There are many times when information from an FEA/FCA is needed on a recurring basis. It is an easy process to save and recall FEA/FCAs.

### Saving an FEA/FCA

Only active FEA/FCAs can be saved. To save an FEA/FCA choose **SELECT FEA/FCA** from the FEA/FCA pull down menu, select the name of the FEA/FCA to be saved, and under the **File** menu select **Save FEA/FCA**. A panel will appear that will allow the name of the FEA/FCA to be saved to be input. Select the name of the FEA/FCA to be saved and push **OK**.

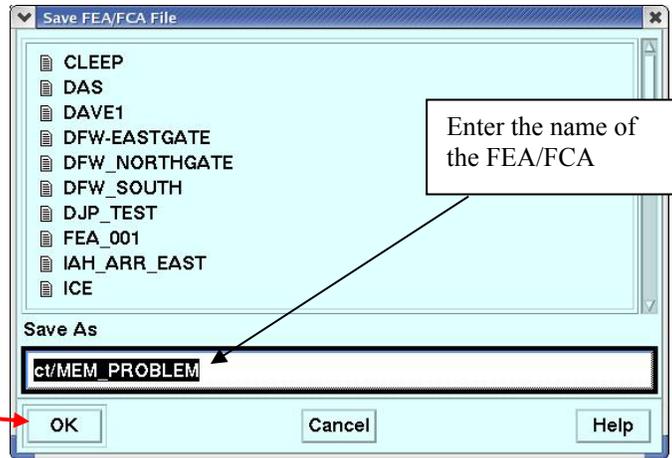
Create the FEA/FCA to be saved then:

STEPS	DESCRIPTION																												
<p>STEP 1: Choose <b>Select FEA/FCA</b> from the FEA/FCA menu.</p>																													
<p>STEP 2: Highlight the number of the FEA/FCA to be saved.</p>	 <table border="1" data-bbox="618 1115 1365 1398"> <thead> <tr> <th>Show</th> <th>Domain</th> <th>Type</th> <th>Color</th> <th>FEA/FCA Name</th> <th>Facility</th> <th>Info</th> </tr> </thead> <tbody> <tr> <td><input type="checkbox"/></td> <td>PUBLIC</td> <td>FCA</td> <td>Red</td> <td>FCA001</td> <td>FSA</td> <td></td> </tr> <tr> <td><input type="checkbox"/></td> <td>PUBLIC</td> <td>FCA</td> <td>Green</td> <td>FCA002</td> <td>FSB</td> <td></td> </tr> <tr> <td><input checked="" type="checkbox"/></td> <td>PRIVATE</td> <td>FEA</td> <td>Blue</td> <td>MEM_PROBLEM</td> <td>OKC</td> <td></td> </tr> </tbody> </table>	Show	Domain	Type	Color	FEA/FCA Name	Facility	Info	<input type="checkbox"/>	PUBLIC	FCA	Red	FCA001	FSA		<input type="checkbox"/>	PUBLIC	FCA	Green	FCA002	FSB		<input checked="" type="checkbox"/>	PRIVATE	FEA	Blue	MEM_PROBLEM	OKC	
Show	Domain	Type	Color	FEA/FCA Name	Facility	Info																							
<input type="checkbox"/>	PUBLIC	FCA	Red	FCA001	FSA																								
<input type="checkbox"/>	PUBLIC	FCA	Green	FCA002	FSB																								
<input checked="" type="checkbox"/>	PRIVATE	FEA	Blue	MEM_PROBLEM	OKC																								
<p>STEP 3: Click on <b>Save FEA/FCA file</b> from the <b>File</b> menu</p>																													

**STEP 4:**

Enter the name of the FEA/FCA to be saved if other than the current name (the current name will show up in the Name window).

Then Click < OK >.



**Recalling an FEA/FCA**

To recall a saved FEA/FCA, select **Recall FEA/FCA File** from the **FEA/FCA** menu. This will bring up a list of saved FEA/FCAs. Select the FEA/FCA to be recalled and push **OK**.

STEPS	DESCRIPTION
<p><b>STEP 1:</b> Select <b>Recall FEA/FCA File</b> from the <b>FEA/FCA</b> menu.</p>	
<p><b>STEP 2:</b> Select/Enter the name of the FEA/FCA file to be recalled, and push &lt;OK&gt;.</p>	

## Appendix B — FEA/FCA References

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This section provides links to documents/references containing more information about FCAs/FEAs.

Document	Location
FEA/FCA Concept of Operations, Oct2004	<a href="http://www.metronaviation.com/cdm/Workgroups/FCA-Reroute.html">http://www.metronaviation.com/cdm/Workgroups/FCA-Reroute.html</a>
FEA/FCA Instructor's Guide	<a href="http://www.metronaviation.com/cdm/Workgroups/CDM_Training/tool_training.html">http://www.metronaviation.com/cdm/Workgroups/CDM_Training/tool_training.html</a>
FEA/FCA Briefing, Jim Ries, TMO, ZOB	<a href="http://www.metronaviation.com/cdm/Workgroups/FCA-Reroute.html">http://www.metronaviation.com/cdm/Workgroups/FCA-Reroute.html</a>
FEA/FCA Applications Guide	<a href="http://www.metronaviation.com/cdm/Workgroups/FCA-Reroute.html">http://www.metronaviation.com/cdm/Workgroups/FCA-Reroute.html</a>
CCSD User Manual	<a href="http://www.metronaviation.com/cdm/products/ccsd.html">http://www.metronaviation.com/cdm/products/ccsd.html</a>
FCA/FEA Weekly Report	<a href="http://www.mitrecaasd.org/s2000/">http://www.mitrecaasd.org/s2000/</a>
ETMS Manual	<a href="http://www.atcsc.faa.gov/Automation/pubs/tsddocumentation.pdf">http://www.atcsc.faa.gov/Automation/pubs/tsddocumentation.pdf</a> (For those who have access to the ATCSCC intranet)
FEA/FCA Procedures	To be added when 8.0 version is completed – April, 2005.

## Appendix C — Glossary

<b>Acronym/ Abbreviation</b>	<b>Definition</b>
ADVZY	Advisory
ARTCC	Air Route Traffic Control Center
ATC	Air Traffic Control
ATCAA	Air Traffic Control Assigned Airspace
ATCSCC	Air Traffic Control Systems Command Center
CCSD	Common Constraint Situation Display
DoD	Department of Defense
EAA	Experimental Aircraft Association
ETMS	Enhanced Traffic Management System
FCA	Flow Constrained Area
FEA	Flow Evaluation Area
FOC	Flight Operations Center
MAP	Monitor Alert Parameter
MIT	Miles In Trail
MOA	Military Operating Area
NAS	National Airspace System
NTML	National Traffic Management Log
SUA	Special Use Airspace
SWAP	Severe Weather Avoidance Plan
Telcon	Telephone Conference
TFR	Temporary Flight Restriction
TMC	Traffic Management Coordinator
TMI	Traffic Management Initiative
TMS	Traffic Management Specialist
TMU	Traffic Management Unit
TRACON	Terminal Radar Approach Control
TSD	Traffic Situation Display
UPT	User Preferred Trajectory
VIP	Very Important Person
Wx	Weather

<b>Identifier</b>	<b>Location/Facility</b>
ATL	Hartsfield – Jackson Atlanta International Airport
BKW	Beckley Vortac
BWI	Baltimore-Washington International Airport
CLE	Cleveland-Hopkins International Airport
CXR	Chardon VOR/DME
CZY	Toronto Center
DCA	Washington National Airport
DFW	Dallas-Fort Worth International Airport
EAU	Eau Claire Vortac
EWR	Newark Liberty International Airport

<b>Identifier</b>	<b>Location/Facility</b>
FSD	Sioux Falls Vortac
HOU	Houston Airport
IAD	Washington Dulles International Airport
IAH	Houston George Bush Intercontinental Airport
IRW	Oklahoma City Will Rogers Vortac
JFK	John F. Kennedy International Airport
LAS	Las Vegas McCarran International Airport
LAX	Los Angeles International Airport
MSP	Minneapolis International Airport
ONL	O’Neill Vortac
PER	Ponca City Pioneer Vortac
PHL	Philadelphia International Airport
PWE	Pawnee City Vortac
SLN	Salina Vortac
SPS	Wichita Falls Vortac
TVC	Traverse City Vortac
ZAB	Albuquerque ARTCC
ZAN	Anchorage ARTCC
ZAU	Chicago ARTCC
ZBW	Boston ARTCC
ZDC	Washington ARTCC
ZDV	Denver ARTCC
ZFW	Fort Worth ARTCC
ZID	Indianapolis ARTCC
ZJX	Jacksonville ARTCC
ZKC	Kansas City ARTCC
ZLA	Los Angeles ARTCC
ZMP	Minneapolis ARTCC
ZOB	Cleveland ARTCC
ZTL	Atlanta ARTCC

## Appendix D — Acknowledgements

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*NAS Customers:*

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Delta Airlines  
Northwest Airlines  
National Business Aircraft Association (NBAA)

*FAA:*

Air Traffic Control System Command Center (ATCSCC)  
Albuquerque Air Route Traffic Control Center (ZAB)  
Anchorage Air Route Traffic Control Center (ZAN)  
Atlanta Air Route Traffic Control Center (ZTL)  
Cleveland Air Route Traffic Control Center (ZOB)  
Denver Air Route Traffic Control Center (ZDV)  
Fort Worth Air Route Traffic Control Center (ZFW)  
Kansas City Air Route Traffic Control Center (ZKC)  
Los Angeles Air Route Traffic Control Center (ZLA)  
Mike Monroney Aeronautical Center (FAA Academy)  
Minneapolis Air Route Traffic Control Center (ZMP)  
Southern California TRACON (SCT)  
Toronto Center, Canada (CZY)

*Other:*

Mitre Center for Advanced Aviation Systems Development (CAASD)  
ATO-R TAC2/Northrop Grumman/CTA  
Volpe National Transportation Systems Center