Airspace Technology Demonstration 2 (ATD-2)

CDM CAT NTML Lessons Learned

October 9, 2019

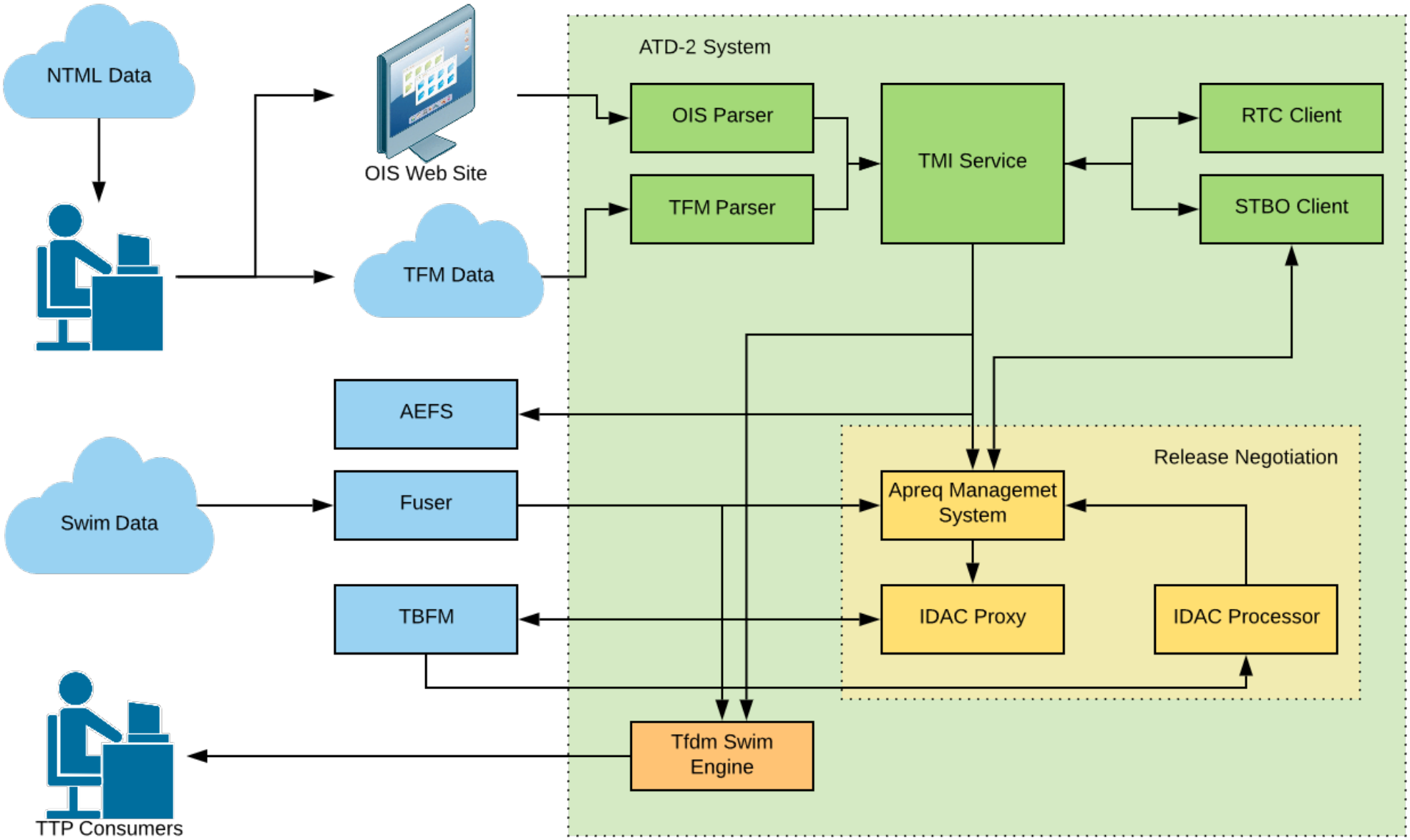
Bob Staudenmeier

ATD-2 Role in TMI Management

Reduce verbal communication and streamline restriction compliance in the NAS by:

1. Automatic utilization of electronic Traffic Management Initiatives (TMIs)
2. Providing situational awareness of TMIs
3. Providing tools to manage TMIs within the ATD-2 system
4. Interfacing with existing FAA systems to improve the speed and accuracy of decisions related to TMI affected flights
5. Distributing flight and TMI data via TFDM Terminal Publication (TTP) SWIM feed

High Level Architecture



OIS - Challenges

- Restriction column in OIS table is free text
  - Typos in keywords
  - Keywords out of expected order (e.g. start/end time values before APREQ/MIT keyword when they are expected after)
  - Precision matters!

Example: STOP CLT to CLT via NORTH JOJJO 1834-1930 WX:TSTMS ZTL:CLT

- NORTH was interpreted as the closure with JOJJO marked as an inclusion constraint
- Resulted in all fixes in the NORTH departure gate being closed
- TMI was intended to only close JOJJO

OIS – Challenges Cont.

- Not all restriction types are available from OIS
- Not all airports/centers publish data to OIS
- OIS page does not display future restrictions
- Restriction only show after they have started
- Lag time between when a restriction goes into affect and when it shows on the OIS page (9 min. average lag)
- Occasional OIS page down time results in missing restrictions
- Unexpected changes to page URL, format, or permissions could result in a loss of data

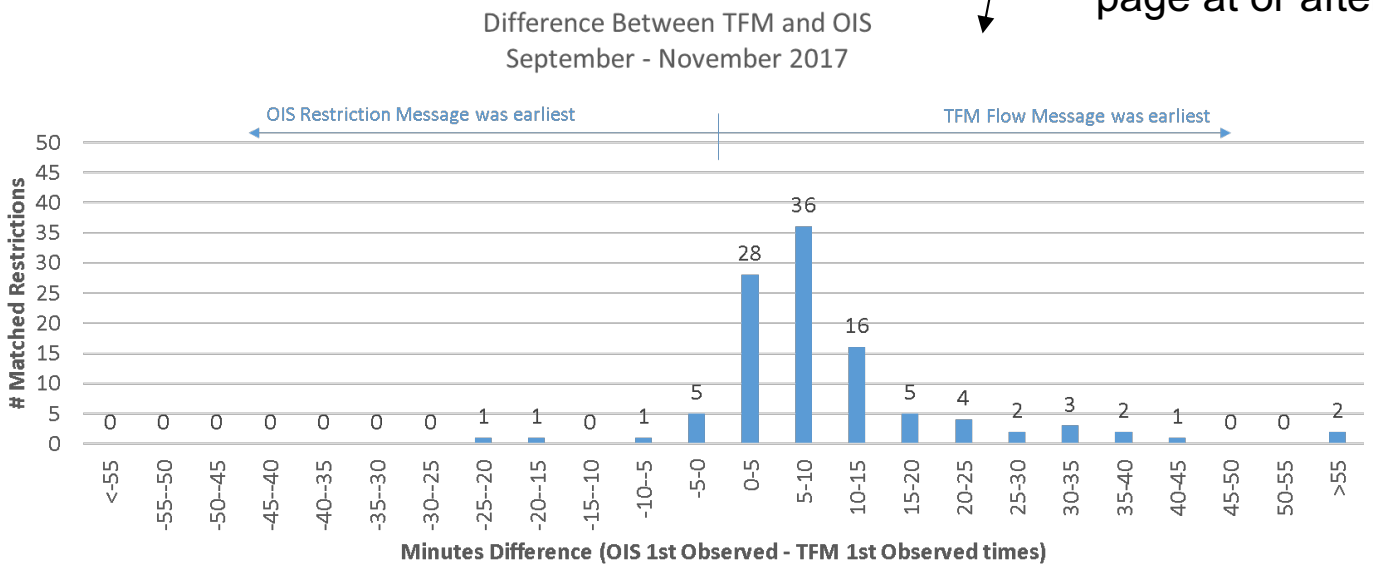
TFM Challenges

- APREQs are not currently observed in TFM Flow.
- Manual entry of the restrictions can result in typos that cause difficulties in parsing or dropped data.
- If TMIs are not entered into NTML, they may not end up in TFM Flow. FDIO, phone, or internal systems may be used to distribute TMI information.
- If ATC makes a free text log entry rather than using NTML's restriction panel the automated publishing of the restriction data may not happen.
- Ground Stop advisories are usually generated automatically when a Ground Stop is entered into FSM. However, some stops are initiated verbally with a free-text advisory manually created. These stops will not follow the same format as the automated Ground Stop advisories.
- Requires a well defined and consistent process of generating the TFM messages
- Value added qualifier and remarks fields contain center specific formatting
- Refresh messages are difficult to decipher and match

TMI Evolution: TFM Flow – Value to ATD-2

TMI	OIS	TFM Flow	NTML
Airport Information	NO	YES	YES
Airspace Flow Programs	NO	YES	YES
Ground Delay Programs	NO	YES	YES
Ground Stops	NO	YES	YES
Miles/Minutes in Trail	YES	YES	YES
Altitude Restrictions	YES	YES	YES
APREQs	YES	NO	YES
Advisories	NO	YES	YES
Closures (Fixes, etc.)	YES	YES	YES
FADT	NO	YES	NO
RAPT	NO	YES	NO
CTOP	NO	YES	NO
DICE	NO	YES	NO
REROUTEs	NO	YES	NO
TMI FLIGHT LIST	NO	YES	NO

- A source comparison was conducted, looking at several days' data from the OIS restrictions page, TFM Flow, and NTML entries
- A combination of OIS restrictions page and TFM Flow data was the recommended source
- Later, comparison between TFM Flow and the OIS restrictions page revealed restrictions in TFM Flow messages typically arrived several minutes before the appearing OIS restrictions page. Also, that restrictions only appeared on the OIS page at or after the restriction start time.

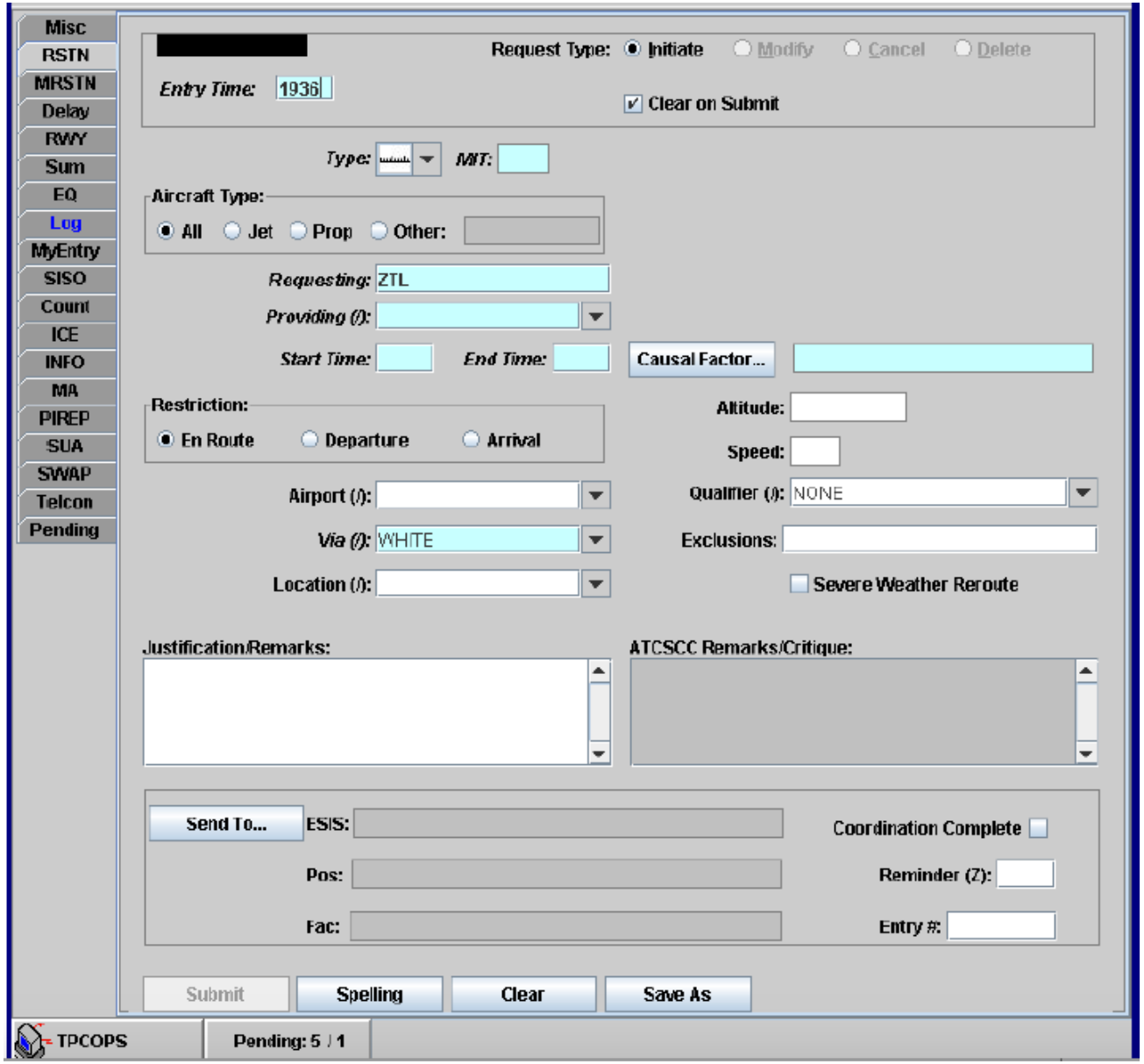


TMI Service Capabilities

- Authoritative TMI repository across all ATD-2 components
- Processes, stores, de-conflict, and distribute TMI's
- Automatically recognizes and tags flights constrained by an active or future TMI event.
- Support persistent TMI's spanning multiple days (e.g. taxiway closures)
- Handles the following TMI data:

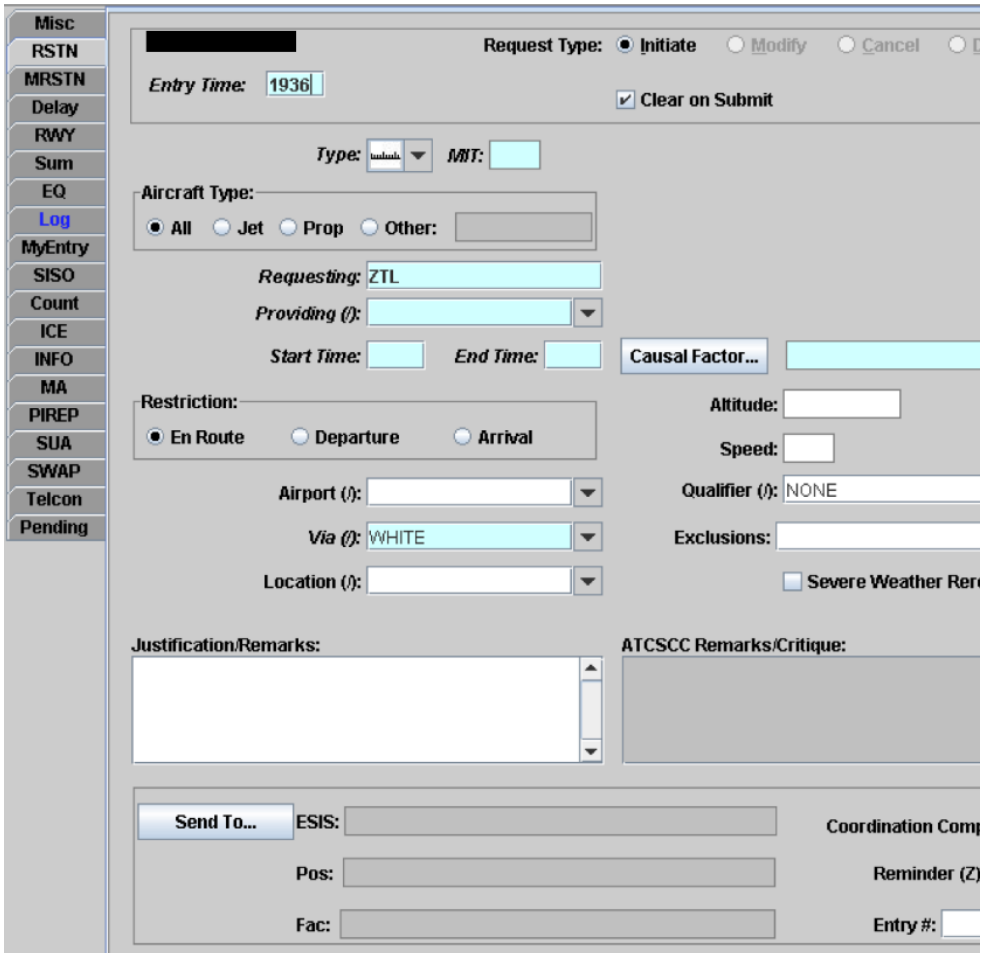
TMI Type	Possible Sources
Runway Utilization	User
APREQs	User, OIS
Surface Metering Programs	Scheduler
Departure Fix Closures	User, TFM, OIS
Departure Gate Closures	User, TFM, OIS
Ground Delay Programs	TFM
Ground Stops	User, TFM
MITs	User, TFM, OIS
Ramp Closures	User
Runway Closures	User
Scheduled Metering Modes	User
Taxiway Closures	User

National Traffic Management Log (NTML) Restriction



TMI Evolution: TFM Flow - Data Origin

- The process of TMIs getting to TFM Flow messages is currently being investigated (by observation at D10)
- In general, the process appears to be:
  - TRACON/ARTCC TMC determines need for TMI
  - Requesting facility TMC enters restriction in NTML using the Restriction Panel
  - Automation broadcasts the restriction via TFM Flow



D10 NTML Entries MISC Tab

2048	3 E MRSSH ON FORCK	VE
2057	2032-2057 BYP: CLSD TO DFW [CANCELLED]	VE
2058	CFR MSP	VE
2058	BYP: DFW 15 MIT	VE
2116	2033-2116 UKW: CLSD TO DAL AND E SAT TRAFFIC [CANCELLED]	VE
2132	W TWR ON VECTORS	VE
2133	2 W HUDAD/HRPER ON KATZZ	VE
2134	JEN DFW BOUNDARY @110	RZ
2207	2048-2207 3 E MRSSH ON FORCK [CANCELLED]	RZ
2207	1 E FORCK 10MIT	RZ
2210	2133-2210 2 W HUDAD/HRPER ON KATZZ [CANCELLED]	RZ
2210	1 W KATZZ	RZ
2210	DR1 VECTORS	RZ
2226	2058-2226 BYP: DFW 15 MIT [CANCELLED]	RZ
2226	BYP DFW STOPPED	RZ
2226	BYP DAL STOPPED	RZ
2242	2210-2242 1 W KATZZ [CANCELLED]	RZ
2242	2 W HUDAD ON HRPER/ KATZZ ON WSTEX	RZ
2314	3 N GRA ON AKU/10 MIT PER	RZ

TMI Evolution:
Traffic Flow Management (TFM)

- TFM Flow data provides added value to the OIS TMI data
- Source for the following TMIs:
  - Restrictions (Type=RSTR)
    - MIT/MINIT
    - Fix Closure (STOP)
  - General Advisories (Type=GADV)
    - Reroutes
    - GDP/GS

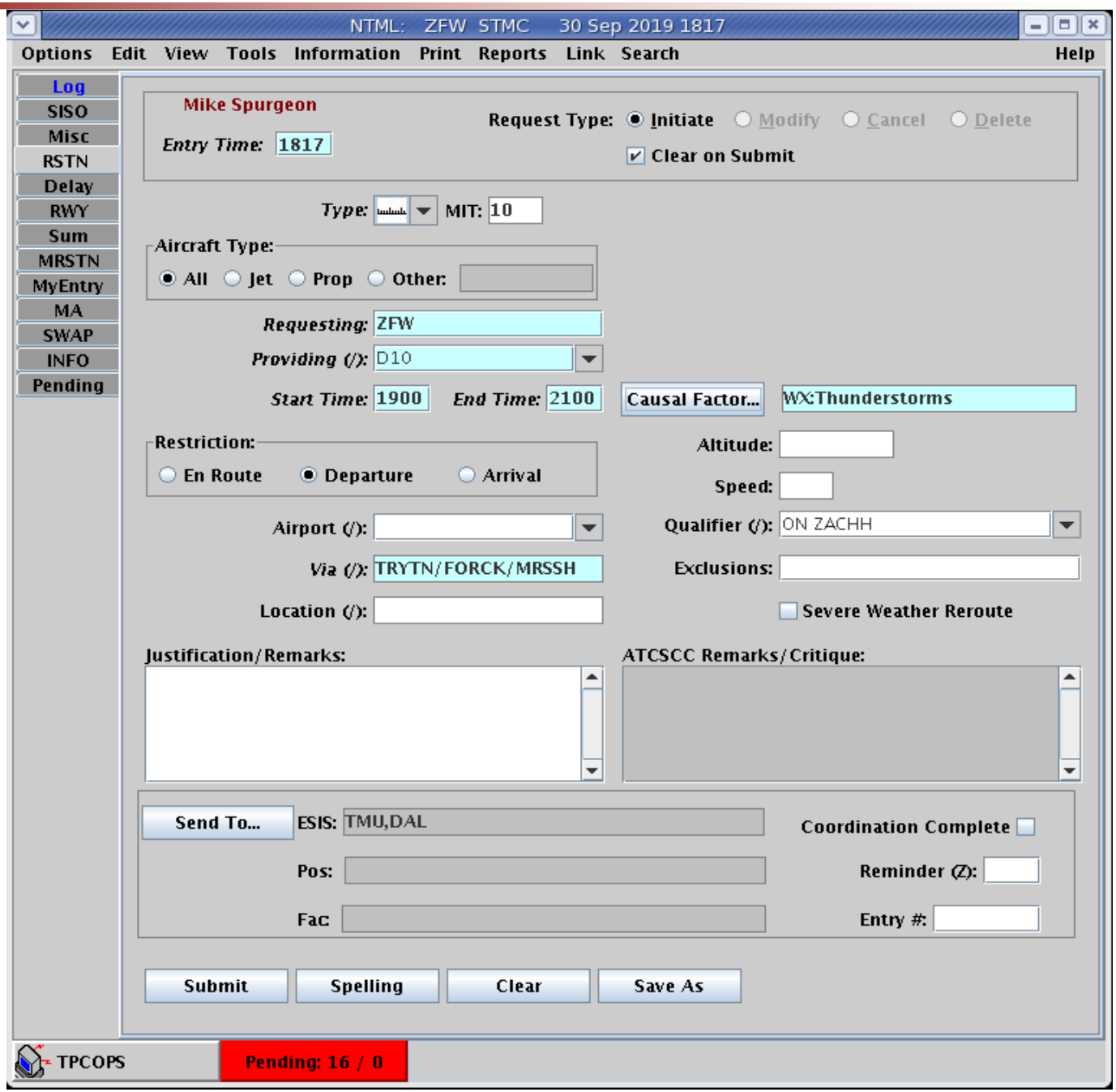
Facility	Total RSTR Msg #	MIT Msg #	MINIT Msg #	STOP Msg #
N90	5590	3002	1637	14
PCT	4504	4389	0	114
PHL	1758	1288	0	31
EWR	1496	16	949	19
LGA	1493	13	948	16
HPN	1040	13	548	15
TEB	979	12	531	19
JFK	959	462	3	13
SCT	932	901	16	14
D21	801	785	0	16
DCA	691	622	0	68
NCT	558	524	0	0
IAD	412	343	0	68
I90	391	382	9	0
BWI	375	321	0	53
ATL	267	252	4	11
F11	214	214	0	0
LAS	202	196	0	6
CLT	154	111	1	41
MSP	107	107	0	0
IND	104	104	0	0

Restriction messages by facility, Sep-Nov 2017
Some messages had multiple types in the same message (e.g. MIT and SPD),
A facility was counted if it was requesting or providing, excluded DCC and ARTCCs.

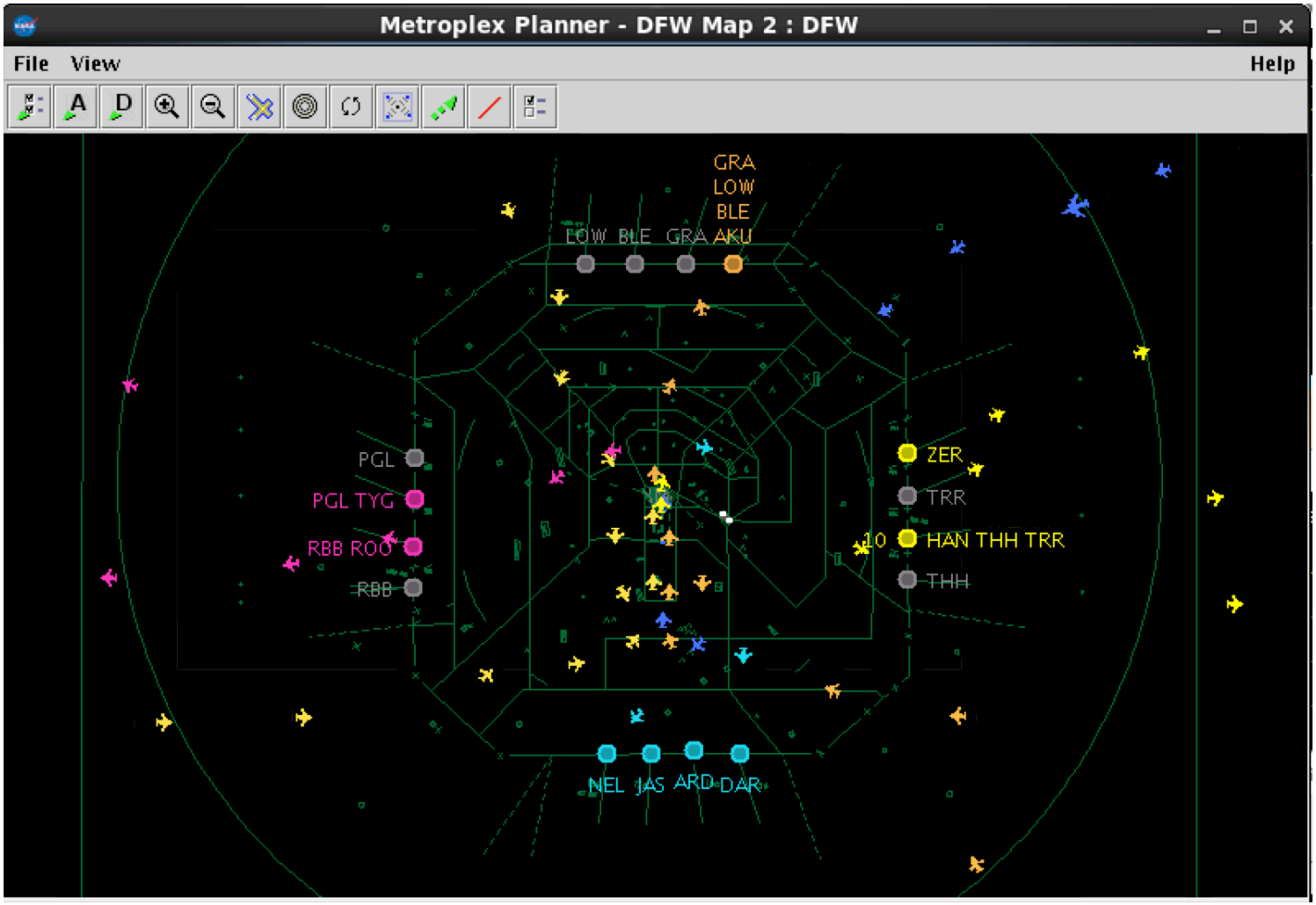
CLT NTML Log Using RSTN Tab

```
2232   TMNC   APREQ: ATL,CLT to DFW                                    XS
              2100-0000, WX:Thunderstorms
              ZTL:ATL,CLT, APREQ: MOD
2232   TMNC   CLT Dept via KILNS,BARMY 10 Mit                          XS
              2045-0000, WX:Thunderstorms
              ZDC:ZTL,CLT, RSTN: MOD
2247   TMNC   GDP CNX BOS                                              XS
              30/2241Z ADVZY=100 BOS/ZBW 06/30/2019
2255   TMNC   STOP: CLT to CLT via NORTH VIA JOJJO, WEAZL/KRITR NORMAL  XS
              2147-0000, WX:TSTMS
              ZTL:CLT, STOP: MOD/APVD 2248/DCC:NE/VM
2350   TMNC   CLT VMC ARR:36L/36C/36R DEP:36C/36R AAR(Strat/Dyn):87/72  XS
              ADJ:Airspace Acceptance/Limitation ADR:60 RMK:LEVEL 4 AND 5
              AREAS OF WX THROUGHOUT NORTH QUADRANT OF TRACON AIRSPACE
              IPACTING ARRIVALS AND DEPARTURES.  (updated at 2350 by CLT)
              FWD:TMDC,DCC,ZTL,ZJX
0004   TMNC   ZTL FLIGHT PLAN DROP INTERVAL IS SET AT 3 HRS MESSAGE    XS
              2340-0400, VOL:Volume
              ZTL:ZDC,ZJX,ZHU,ZID,ZME,ATL,CLT, RSTN: APVD 2358/DCC:NE/RT
0004   TMNC   CANCELLED: CLT Dept via KILNS,BARMY 10 Mit               XS
              2045-2346, WX:Thunderstorms
```

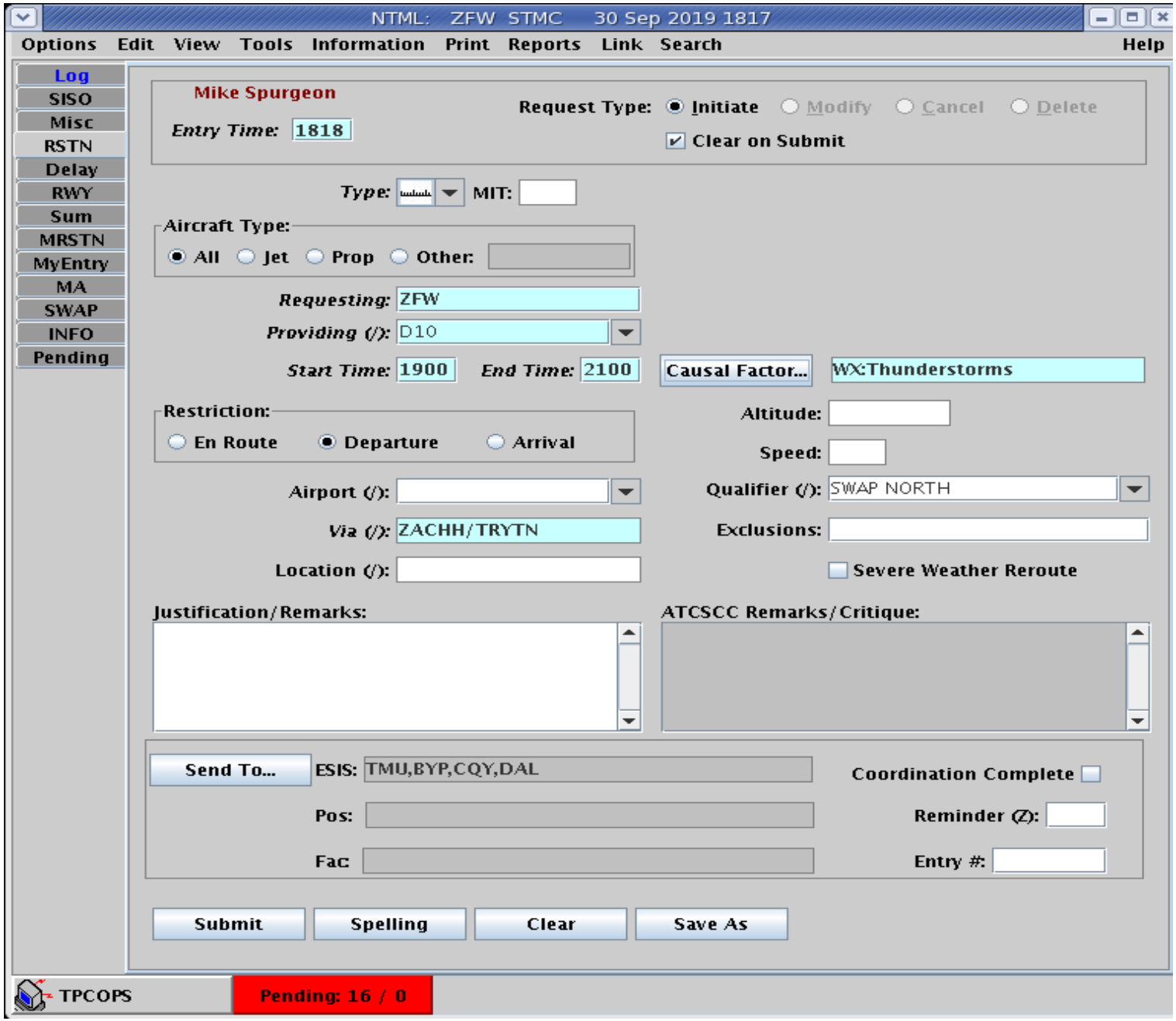
On ZACHH 10 MIT



Map


Metroplex Planner - DFW Map 2 : DFW
File
View
Help
GRA
LOW
BLE
LOW BLE GRA AKU
PGL
PGL TYG
RBB ROO
RBB
ZER
TRR
10 HAN THH TRR
THH
NEL JAS ARD DAR

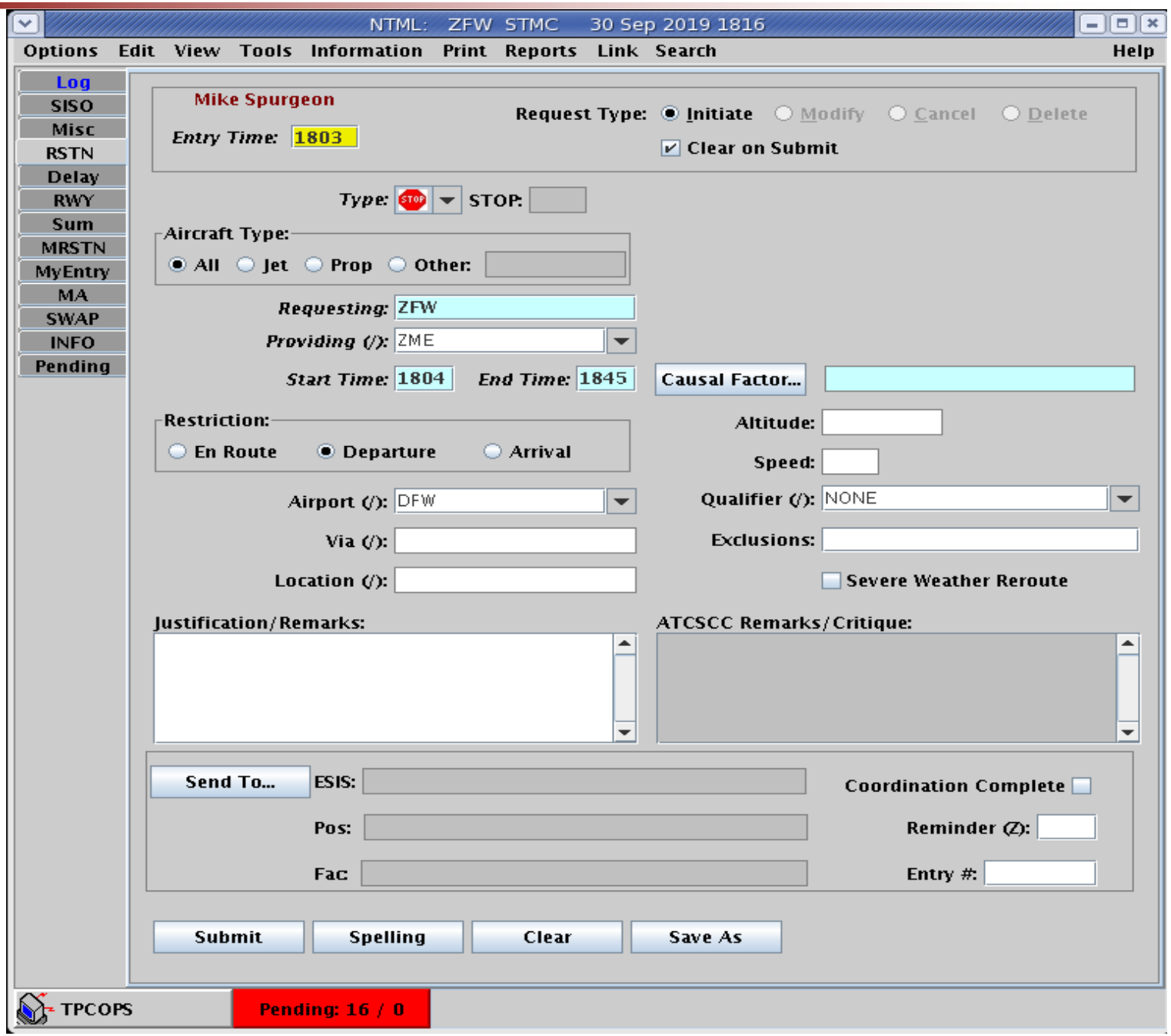
SWAP North


NTML: ZFW STMC 30 Sep 2019 1817
Options Edit View Tools Information Print Reports Link Search Help
Log
SISO
Misc
RSTN
Delay
RWY
Sum
MRSTN
MyEntry
MA
SWAP
INFO
Pending
Mike Spurgeon
Entry Time: 1818
Request Type: Initiate Modify Cancel Delete
Clear on Submit
Type: MIT:
Aircraft Type:
All Jet Prop Other:
Requesting: ZFW
Providing (/): D10
Start Time: 1900 End Time: 2100
Causal Factor... WX:Thunderstorms
Restriction:
En Route Departure Arrival
Altitude:
Speed:
Airport (/):
Qualifier (/): SWAP NORTH
Via (/): ZACHH/TRYTN
Exclusions:
Location (/):
Severe Weather Reroute
Justification/Remarks:
ATCSCC Remarks/Critique:
Send To... ESIS: TMU,BYP,CQY,DAL
Coordination Complete
Pos:
Reminder (Z):
Fac
Entry #:
Submit Spelling Clear Save As
TPCOPS
Pending: 16 / 0

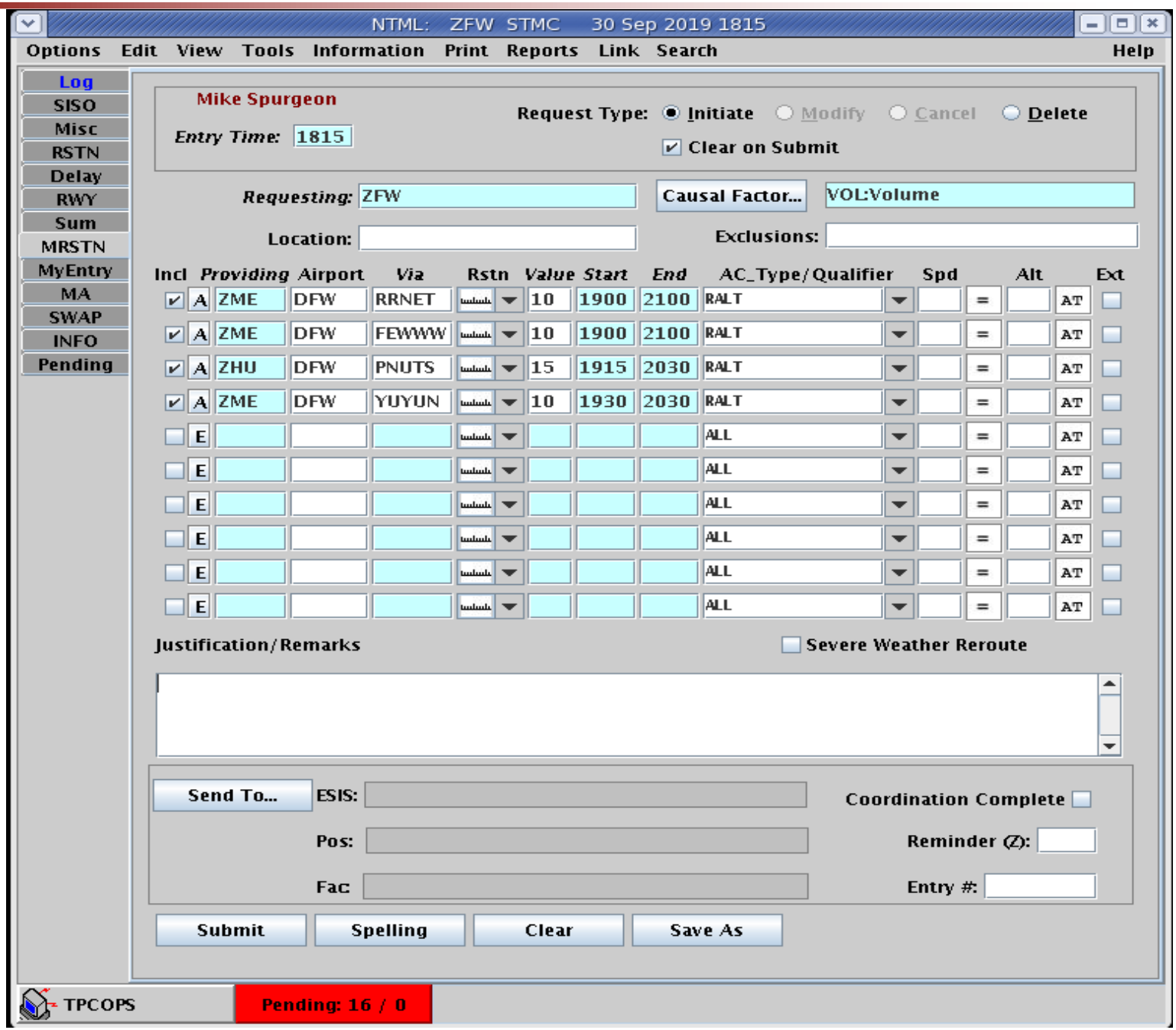
SWAP Entries Using RSTN Tab

NTML ENTRIES FOR SWAPS		
FIX/ROUTE CLOSED	**WITH QUALIFIER AS**	**ASSOCIATED FIXES/ROUTES**
NELYN/NELYN	SWAP WEST SWAP EAST	RBBIT/WSTEX THHOR/MRSSH
JASPA/JASPA	SWAP WEST SWAP EAST	RBBIT/WSTEX THHOR/MRSSH
ARDIA/ARDIA	SWAP WEST SWAP EAST	RBBIT/WSTEX THHOR/MRSSH
DARTZ/DARTZ	SWAP WEST SWAP EAST	RBBIT/WSTEX THHOR/MRSSH
PGLET/HUDAD	SWAP NORTH SWAP SOUTH	LOWGN/LOWGN NELYN/NELYN
TYGGR/HRPER	SWAP NORTH SWAP SOUTH	LOWGN/LOWGN NELYN/NELYN
ROOOO/KATZZ	SWAP NORTH SWAP SOUTH	LOWGN/LOWGN NELYN/NELYN
RBBIT/WSTEX	SWAP NORTH SWAP SOUTH	LOWGN/LOWGN NELYN/NELYN
LOWGN/LOWGN	SWAP WEST SWAP EAST	PGLET/HUDAD ZERLU/ZACHH
BLECO/BLECO	SWAP WEST SWAP EAST	PGLET/HUDAD ZERLU/ZACHH
GRABE/GRABE	SWAP WEST SWAP EAST	PGLET/HUDAD ZERLU/ZACHH
AKUNA/AKUNA	SWAP WEST SWAP EAST	PGLET/HUDAD ZERLU/ZACHH
ZERLU/ZACHH	SWAP NORTH SWAP SOUTH	AKUNA/AKUNA DARTZ/DARTZ
TRRCH/TRYTN	SWAP NORTH SWAP SOUTH	AKUNA/AKUNA DARTZ/DARTZ
HANUH/FORCK	SWAP NORTH SWAP SOUTH	AKUNA/AKUNA DARTZ/DARTZ
THHOR/MRSSH	SWAP NORTH SWAP SOUTH	AKUNA/AKUNA DARTZ/DARTZ

STOP Entry


NTML: ZFW STMC 30 Sep 2019 1816
Options Edit View Tools Information Print Reports Link Search Help
Log
SISO
Misc
RSTN
Delay
RWY
Sum
MRSTN
MyEntry
MA
SWAP
INFO
Pending
Mike Spurgeon
Entry Time: 1803
Request Type: Initiate Modify Cancel Delete
Clear on Submit
Type: STOP: STOP
Aircraft Type:
All Jet Prop Other:
Requesting: ZFW
Providing (/): ZME
Start Time: 1804 End Time: 1845
Causal Factor...
Restriction:
En Route Departure Arrival
Altitude:
Speed:
Airport (/): DFW
Qualifier (/): NONE
Via (/):
Exclusions:
Location (/):
Severe Weather Reroute
Justification/Remarks:
ATCSCC Remarks/Critique:
Send To... ESIS:
Coordination Complete
Pos:
Reminder (Z):
Fac
Entry #:
Submit Spelling Clear Save As
TPCOPS
Pending: 16 / 0

Multiple Restrictions Tab



NTML Tabs

MISC and SWAP tab entries do not show up in TFM data. Also, the SWAP tab only allows 1 entry at a time.

RSTN tab is used for all restrictions including SWAP entries

“TXT” under the TYPE does not work. Just like the “CFR” does not come through TFM Flow

A MIT entered under the RSTN tab does come through to TFM flow prior to the TRACON acknowledgement

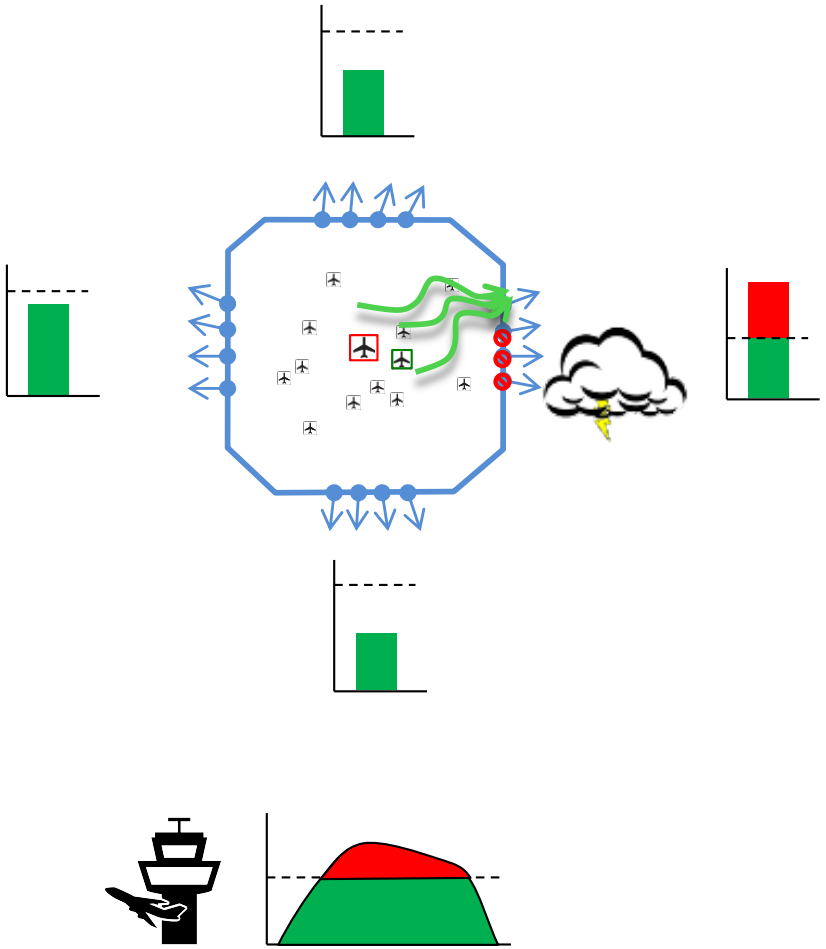
Have not tested all entries

ESIS Training may be necessary-”different look”

Demand Capacity Imbalances in D10 TRACON Airspace

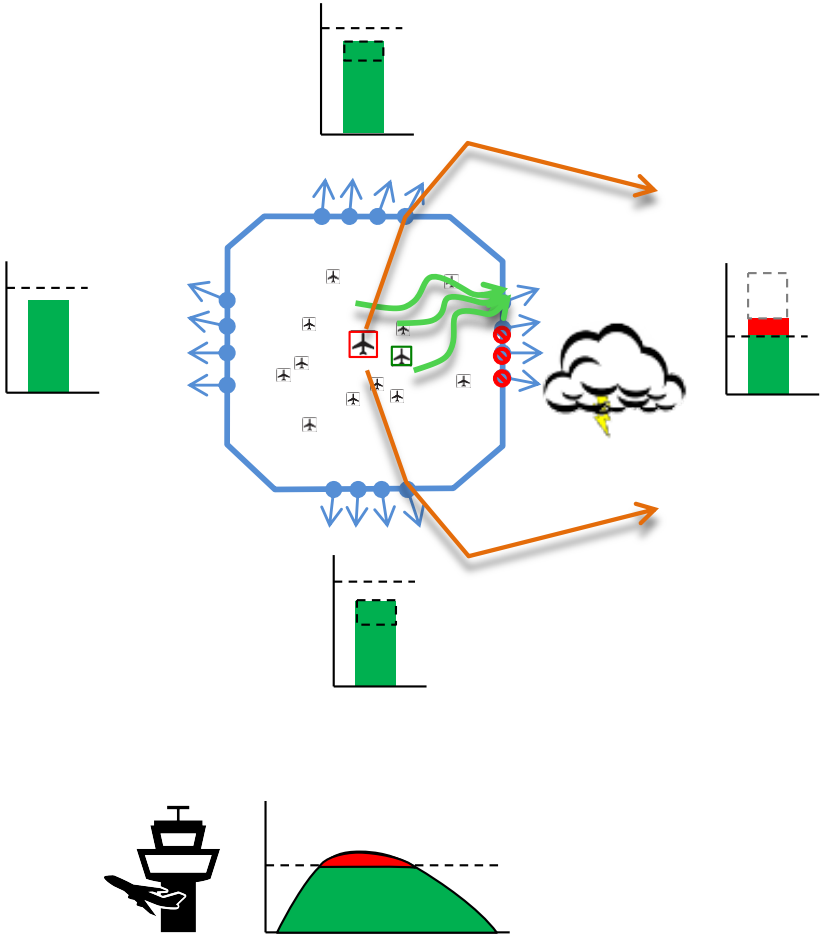
Fix compression caused by weather events near TRACON airspace

Currently



Load Balancing With TOS

(Trajectory Option Set)

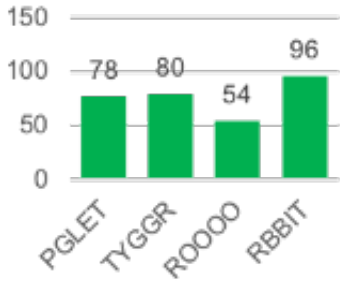


D10 Airspace and Departure Demand

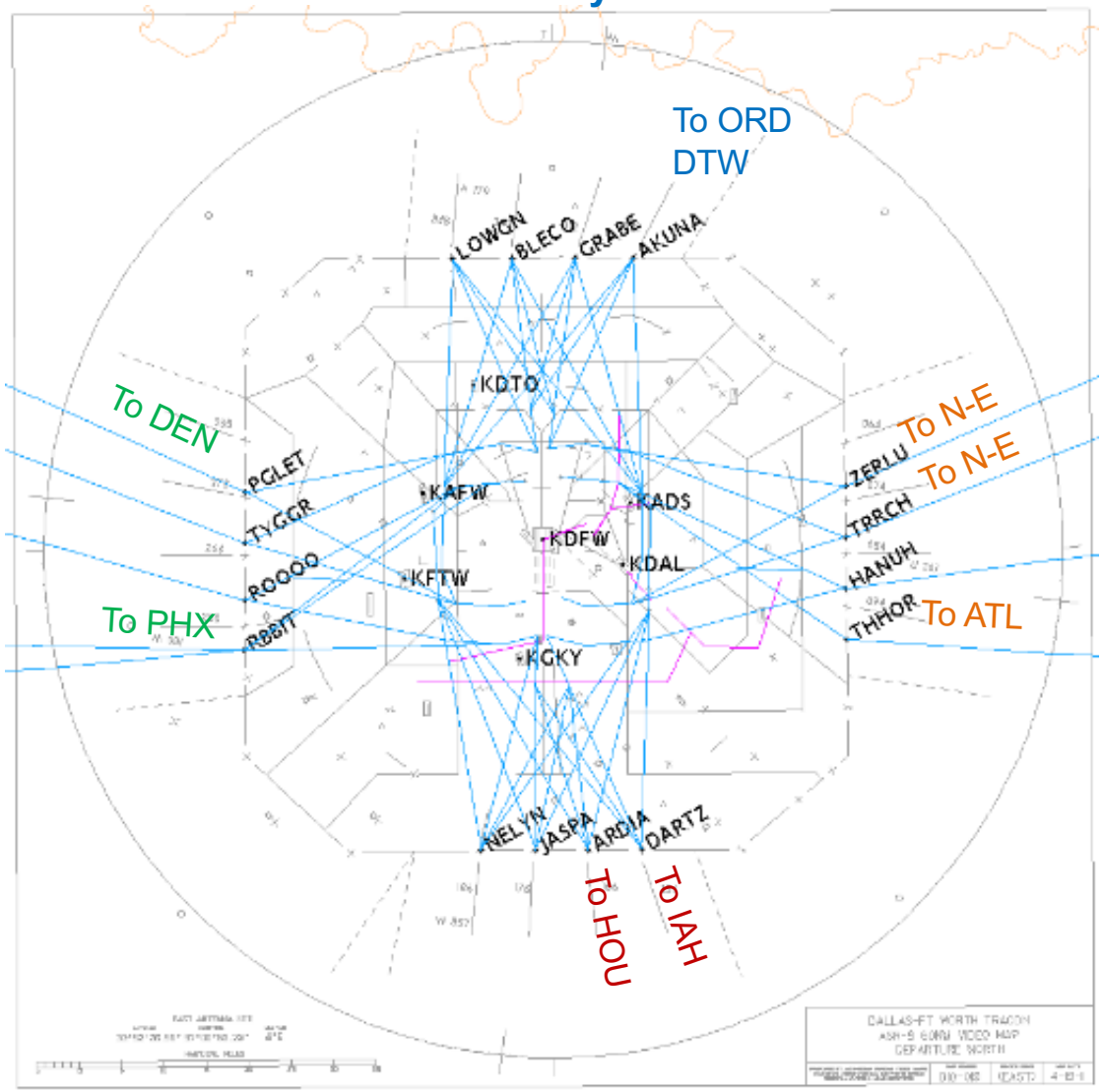
October 2017 departures above 11,000ft

North Gate
252/day

West Gate



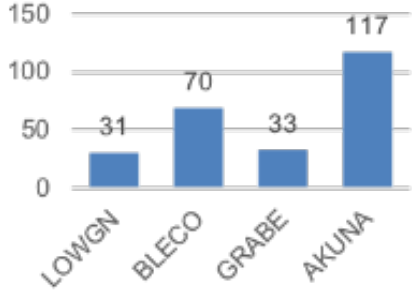
West Gate
306/day



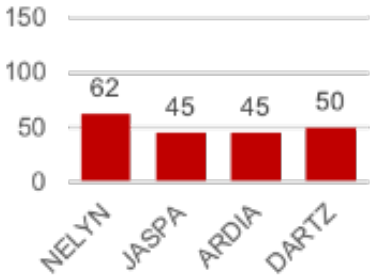
East Gate
435/day

South Gate
201/day

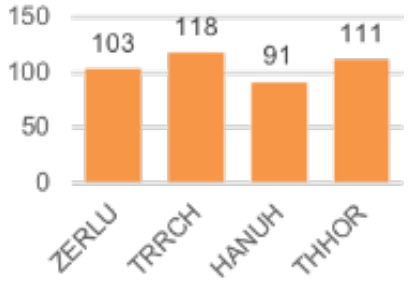
North Gate



South Gate



East Gate



North Texas TMI Summary

Fix Closures

Creation Time	Start Time	End Time	Actual End Time	End Reason	Duration	Fix	Alt Fix	Alt Gate	Source	Inclusions	Exclusions	Creating User
2019-09-26 06:53	2019-09-26 06:55	2019-09-26 10:30	2019-09-26 10:31	EXPIRED	03:36	GRABE	BLECO	NORTH	TFM			
2019-09-26 09:12	2019-09-26 09:15	2019-09-26 12:15	2019-09-26 09:45	CANCELLED	00:30	HANUH	OTG		TFM			
2019-09-26 09:12	2019-09-26 09:15	2019-09-26 12:15	2019-09-26 09:45	CANCELLED	00:30	THHOR	OTG		TFM			
2019-09-26 09:12	2019-09-26 09:15	2019-09-26 12:15	2019-09-26 09:45	CANCELLED	00:30	ZERLU	OTG		TFM			
2019-09-26 09:45	2019-09-26 09:45	2019-09-26 11:45	2019-09-26 10:14	CANCELLED	00:29	TRRCH	HANUH	EAST	TFM			
2019-09-26 09:45	2019-09-26 09:45	2019-09-26 11:45	2019-09-26 10:14	CANCELLED	00:29	ZERLU	HANUH	EAST	TFM			
2019-09-26 10:14	2019-09-26 10:14	2019-09-26 12:00	2019-09-26 10:59	CANCELLED	00:45	HANUH	THHOR	EAST	TFM			
2019-09-26 10:14	2019-09-26 10:14	2019-09-26 12:00	2019-09-26 10:59	CANCELLED	00:45	TRRCH	ZERLU	EAST	TFM			
2019-09-26 12:35	2019-09-26 12:35	2019-09-26 15:00	2019-09-26 13:54	CANCELLED	01:19	AKUNA	BLECO	NORTH	TFM			
2019-09-26 12:35	2019-09-26 12:35	2019-09-26 15:00	2019-09-26 13:54	CANCELLED	01:19	GRABE	BLECO	NORTH	TFM			
2019-09-26 13:55	2019-09-26 13:55	2019-09-26 17:00	2019-09-26 14:22	CANCELLED	00:27	AKUNA	GRABE	NORTH	TFM			

MIT Restrictions

Creation Time	Start Time	End Time	Actual End Time	End Reason	Duration	Fix	Miles in Trail	Source	Inclusions	Exclusions	Creating User
2019-09-26 06:59	2019-09-26 07:00	2019-09-26 10:00	2019-09-26 07:00	CANCELLED	00:00	HANUH	10	TFM			
2019-09-26 09:45	2019-09-26 09:45	2019-09-26 11:45	2019-09-26 09:46	CANCELLED	00:01	HANUH	10	TFM			
2019-09-26 14:37	2019-09-26 14:35	2019-09-26 15:30	2019-09-26 15:31	EXPIRED	00:56	HANUH	10	TFM			
2019-09-26 14:37	2019-09-26 14:35	2019-09-26 15:30	2019-09-26 15:31	EXPIRED	00:56	THHOR	10	TFM			
2019-09-26 14:37	2019-09-26 14:35	2019-09-26 15:30	2019-09-26 15:31	EXPIRED	00:56	TRRCH	10	TFM			

North Texas TMI Summary

Ground Delay Programs

Creation Time	Start Time	End Time	Actual End Time	End Reason	Duration	Destination	Requesting Facility	Reason	Source	Inclusions	Exclusions
2019-08-30 09:14	2019-08-30 12:00	2019-08-30 21:59	2019-08-30 19:46	CANCELLED	07:46	EWR	ZNY		TFM		
2019-08-30 13:00	2019-08-30 15:00	2019-08-30 20:59	2019-08-30 20:59	EXPIRED	05:59	DFW	ZFW	THUNDERSTORMS	TFM		
2019-08-30 18:07	2019-08-30 18:15	2019-08-30 19:59	2019-08-30 19:51	CANCELLED	01:36	DFW	ZFW		TFM		

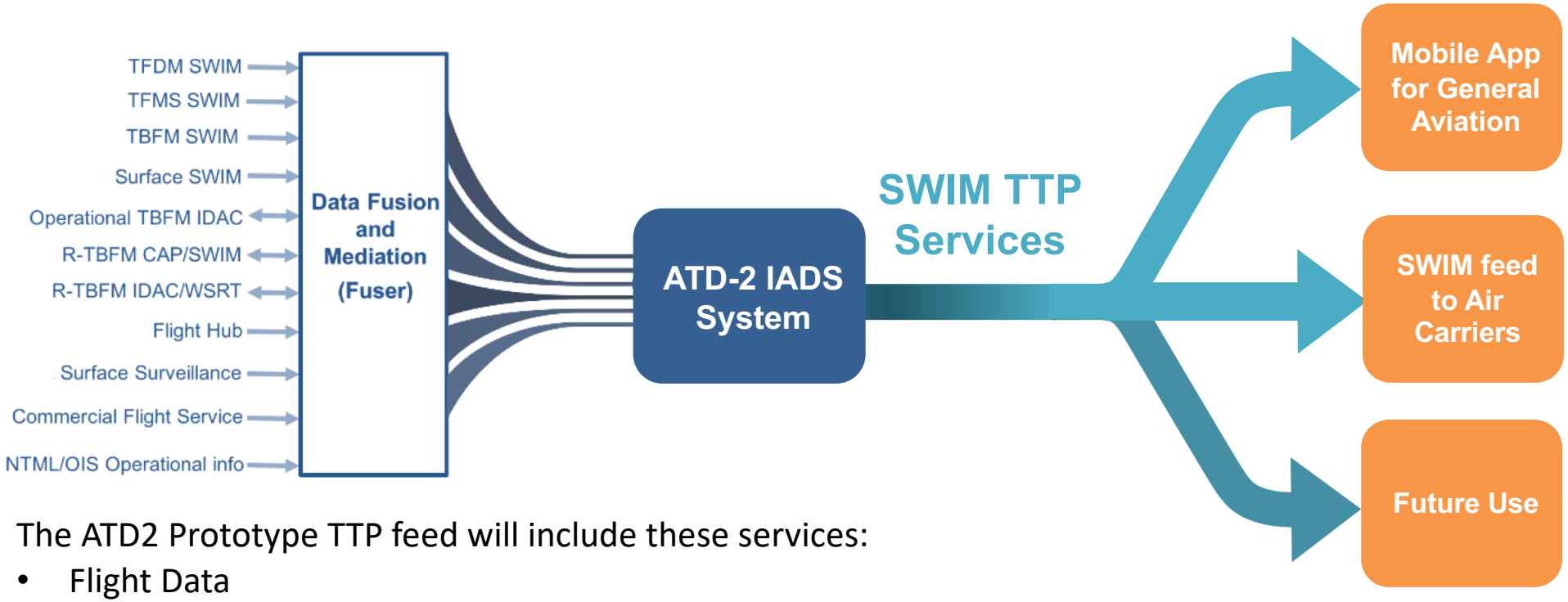
APREQ Restrictions

Creation Time	Start Time	End Time	Actual End Time	End Reason	Duration	Destination	Requesting Facility	Source	Inclusions	Exclusions	Creating User
2019-08-30 06:41	2019-08-30 06:41		2019-08-30 19:59	CANCELLED	13:17	IAH		USER			MP DFW
2019-08-30 07:02	2019-08-30 07:02		2019-08-31 03:00	EXPIRED	19:57	DAL		USER			MP DFW
2019-08-30 07:02	2019-08-30 07:02		2019-08-30 08:29	CANCELLED	01:26	DEN		USER			MP DFW
2019-08-30 11:11	2019-08-30 11:11		2019-08-30 17:09	CANCELLED	05:58	DEN		USER			MP DFW
2019-08-30 17:09	2019-08-30 17:09		2019-08-30 19:59	CANCELLED	02:49	HOU		USER			MP DFW

Questions?

IADS Data Sharing via Prototype TTP

NASA and the FAA are collaborating to provide a prototype TFDM Terminal Publication (TTP) feed via SWIM R&D network as part of the ATD-2 Field Demonstration



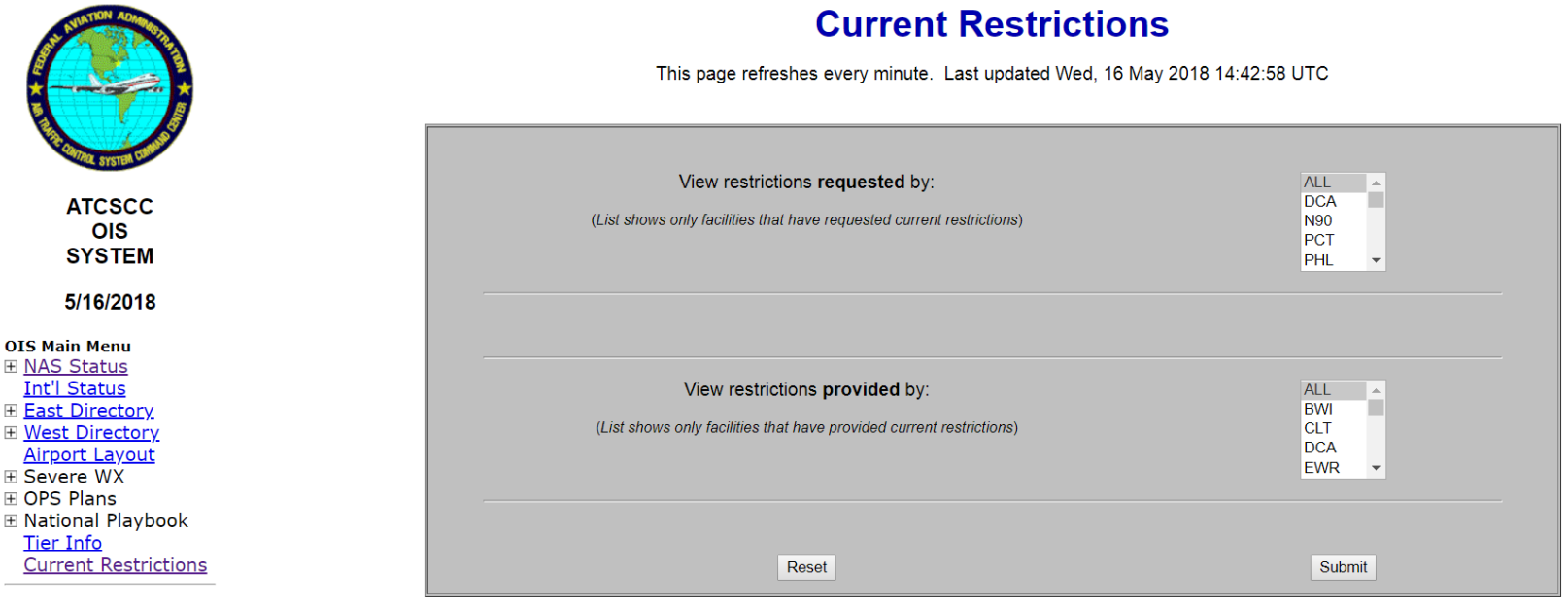
The ATD2 Prototype TTP feed will include these services:

- Flight Data
- Airport Information
- Traffic Management Restrictions
- Flight Delay
- Surface Metering Program
- Operational Metrics

TTP is now available on SWIM R&D for CLT. You are welcome to onboard now!

TMI Evolution:
Operational Information System (OIS)

- Web page managed by ATCSCC that provides information about current restrictions in the NAS including:
  - APREQs
  - MITS
  - Fix Closures
- Accessible at http://www.fly.faa.gov/ois > Current Restrictions
- Filter by requesting and providing facilities



TMI Evolution: OIS - Filtering and Scraping

- Filtering includes CLT or DFW as providing facilities and all requesting facilities
- Scrape HTML data for all 5 columns of the OIS table to use during parsing/interpretation

Current Restrictions

This page refreshes every minute. Last updated Wed, 16 May 2018 14:46:39 UTC

REQUESTING	PROVIDING	RESTRICTION	START TIME	STOP TIME
ZDC	CLT/ZTL	APREQ CLT,ZTL to DCA via BARMY,KILNS JETS 1130-0130 ZDC:CLT,ZTL	05/16/2018 1130	05/17/2018 0130
ZDC	CLT/ZTL	APREQ CLT,ZTL to EWR via BARMY,KILNS JETS 1015-0130 ZDC:CLT,ZTL	05/16/2018 1015	05/17/2018 0130
ZDC	CLT/ZTL	APREQ CLT,ZTL to IAD via BARMY,KILNS JETS 1330-2100 ZDC:CLT,ZTL	05/16/2018 1330	05/16/2018 2100
ZDC	CLT/ZTL	APREQ CLT,ZTL to LGA via BARMY,KILNS JETS 1015-0130 ZDC:CLT,ZTL	05/16/2018 1015	05/17/2018 0130
ZJX	CLT/ZTL	CLT SOUTHBOUND 10MIT SINGLE STREAM 1300-1600 ZJX:ZTL,CLT	05/16/2018 1300	05/16/2018 1600

TMI Evolution:
OIS – Data Storage and Analysis

- Parsed and interpreted data is stored in XML files for reference
- Contains original text from OIS page as well as interpreted data for comparison

Scraped OIS Data

Interpreted Data

```
<ois-envelope timestamp="2018-05-16T15:00:06.871Z">
 <current-restrictions>
  <restriction requesting="ZDC" providing="CLT/ZTL" start-time="2018-05-16T11:30:00.000Z" stop-time="2018-05-17T01:30:00.000Z">
   <text>APREQ CLT,ZTL to DCA via BARMY,KILNS JETS 1130-0130 ZDC:CLT,ZTL</text>
  </restriction>
 </current-restrictions>
 <apreq-restrictions>
  <apreq-restriction start-time="2018-05-16T11:30:00.000Z" stop-time="2018-05-17T01:30:00.000Z">
   <requesting name="ZDC" type="CENTER"/>
   <providing name="CLT" type="AIRPORT"/>
   <providing name="ZTL" type="CENTER"/>
   <origins>
    <origin name="CLT" type="AIRPORT"/>
   </origins>
   <equipment-type>J</equipment-type>
   <text>APREQ CLT,ZTL to DCA via BARMY,KILNS JETS 1130-0130 ZDC:CLT,ZTL</text>
   <constraints>
    <constraint constraintAction="INCLUDE" constraintType="NAS_ELEMENT">
     <constraintValues>
      <constraintValue>FIX:BARMY</constraintValue>
      <constraintValue>FIX:KILNS</constraintValue>
     </constraintValues>
    </constraint>
   </constraints>
   <remove>false</remove>
   <resource-type>DESTINATION</resource-type>
   <destinations>
    <destination name="DCA" type="AIRPORT"/>
   </destinations>
  </apreq-restriction>
 </apreq-restrictions>
 <mit-restrictions/>
 <closures/>
</ois-envelope>
```