Mosaic ATM Products, Techniques for Greater Efficiency

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Mosaic ATM

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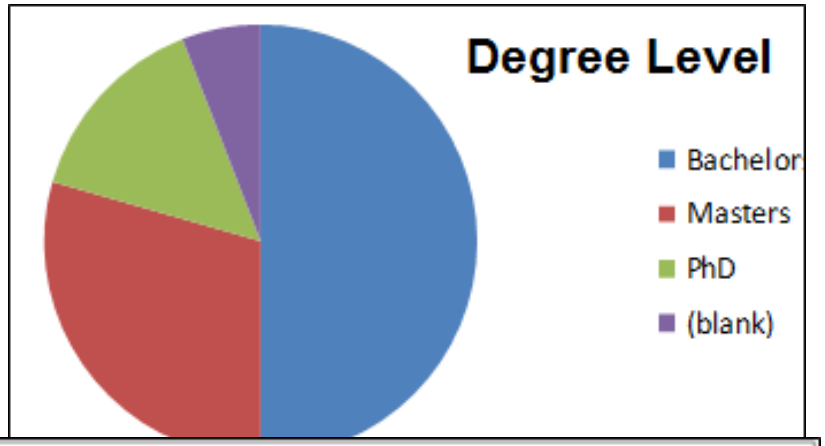
MOSAIC ATM
Innovators for the Next Generation of Aviation

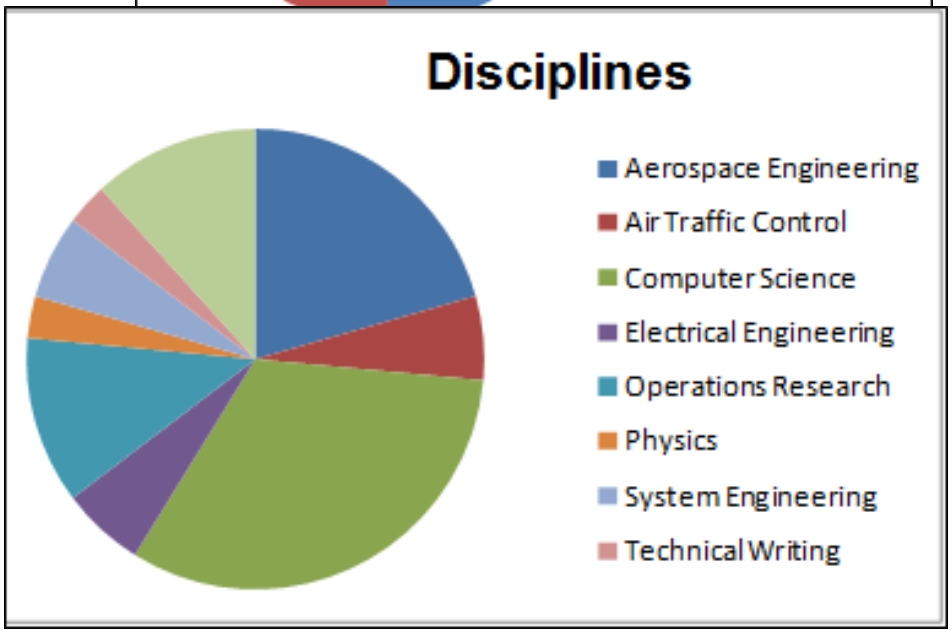
Agenda

- Who are Mosaic ATM?
- Filling the gap between operators and ATC
- Fundamental shift – data sharing
- SWIM data
- Analytics
- Participating in CTOP
- Putting it all together

Mosaic ATM

- Incorporated 2004
- Mission - To improve the effectiveness of complex aviation-related operations
- ~50 employees
- ~$10M annual revenue
- 2013 Air Traffic Control Association's Small Business of the Year Award
- Commercial Focus: Help operators use ATC to advantage





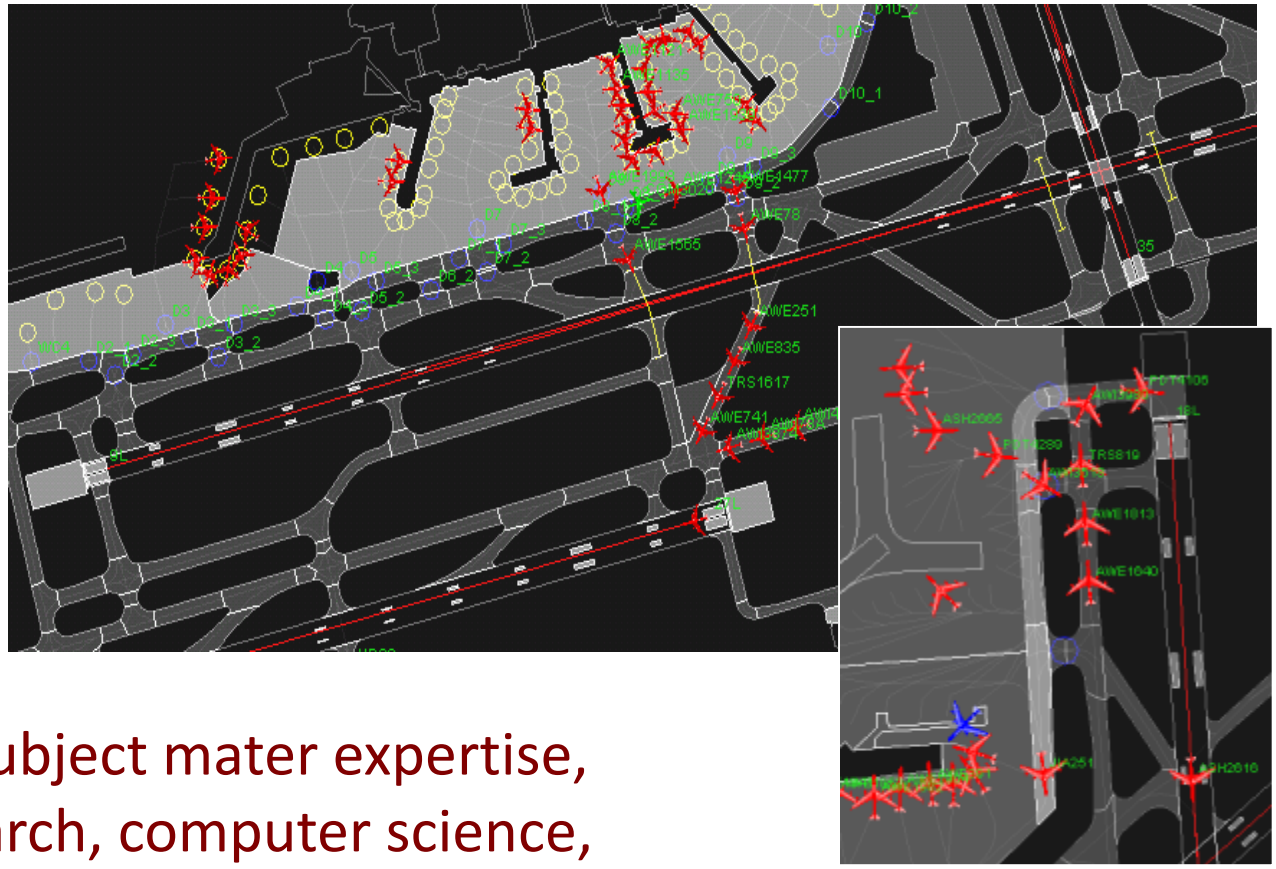
MOSAIC ATM
Innovators for the Next Generation of Aviation

Commercial Experience

- Serving commercial airlines since 2004
  - Major overnight cargo airline – SDSS customizations, 24x7x365 support, ADS-B augmentation, operational efficiency metrics
  - Another major overnight express shipment airline – SDSS + MSV, ADS-B augmentation, ADS-B primary-source surveillance
  - SWIM data services for major on-demand airline
  - 2nd tier components to industry providers of airline tools
  - CTOP collaboration with a major airline
- Strategic thrust to expand non-Government business in 2016
- Commercial mission: helping aviation organizations understand and work with ATM

Mosaic ATM

- Early research → prototype deployment → support operational use of deployed systems

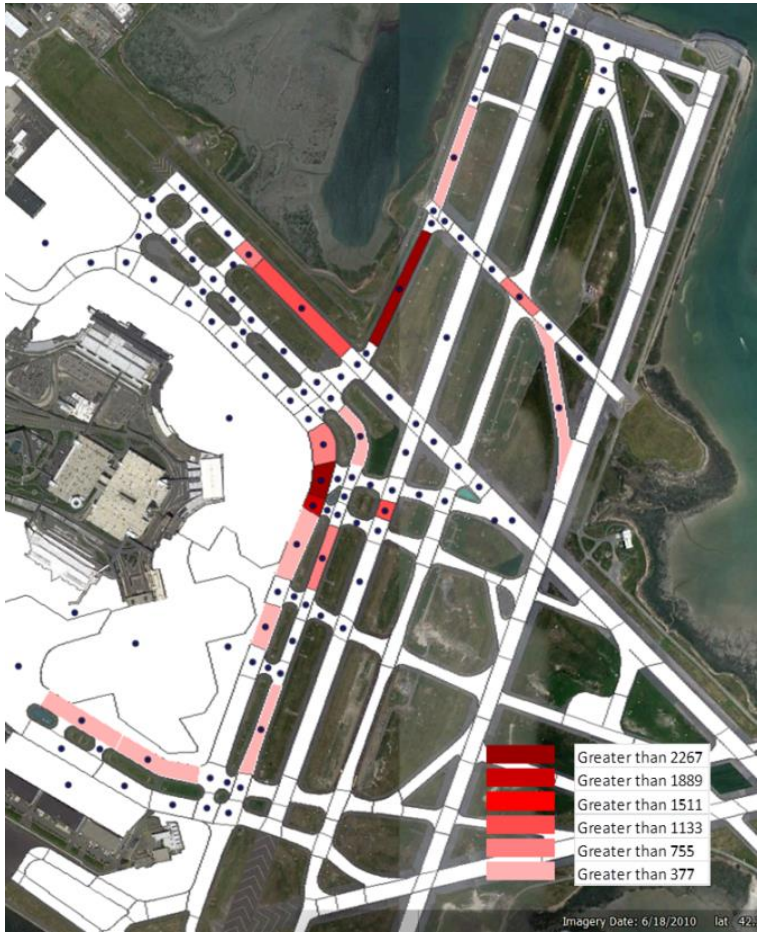


Metroplex Simulation Environment

- Bring together subject mater expertise, operations research, computer science, human factors, system engineering, and project management

Mosaic ATM

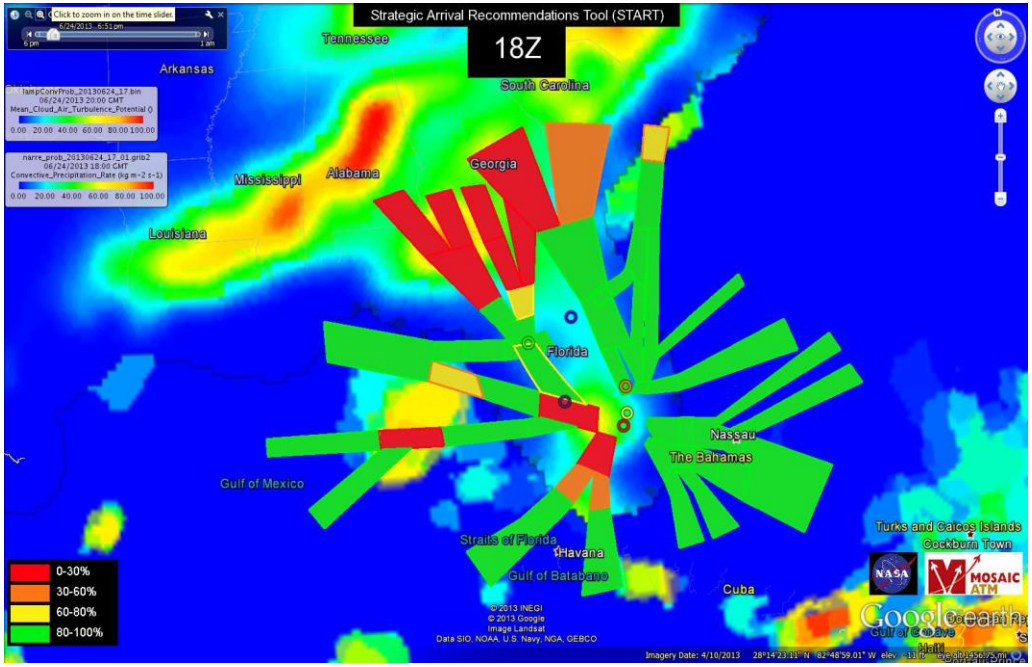
- Original and applied ATM research and development for FAA and NASA
- Specialize in airport surface, TFM, Wx integration, SWIM applications including GUFI/flight matching
- Leverage knowledge from Government work to produce commercial products and services
- Customer-focused, agile approach yields practical solutions



Automated analysis of taxi segment usage and taxi delay location

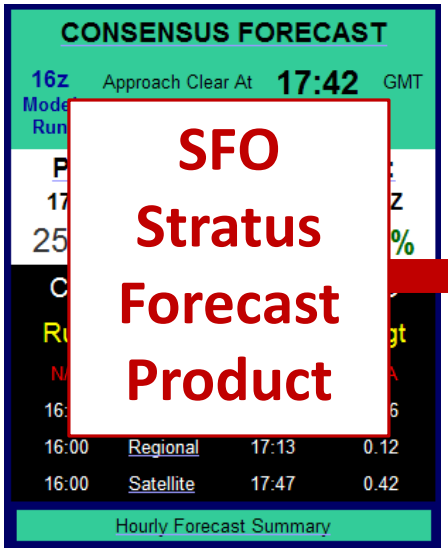
Strategic Arrival Reroute Tool

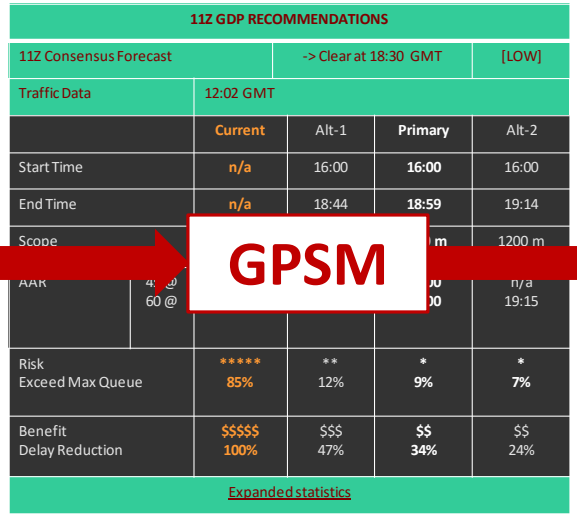
- ATM-Wx Integration
- Evaluates convection forecasts over arrival corridors
- Translates into hourly capacity predictions for corridor segments (stochastic)
- Visualize excess demand and available capacity

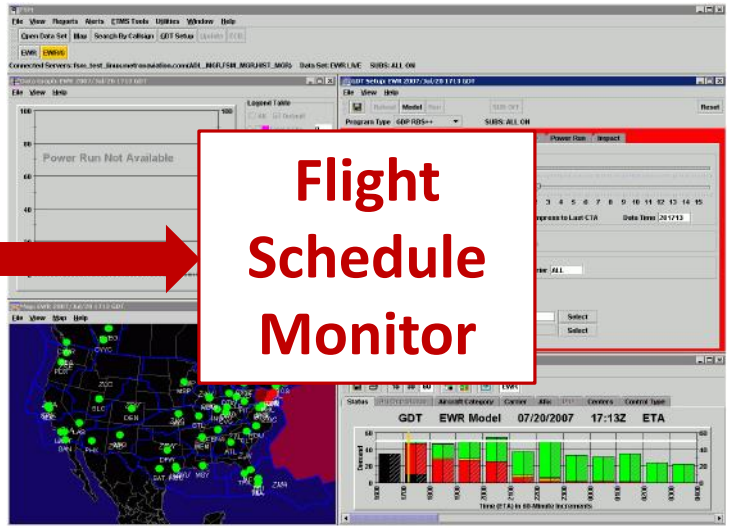


Phase I Prototype Evaluated by ZMA TMU (Summer 2013)

GDP Parameter Selection Model

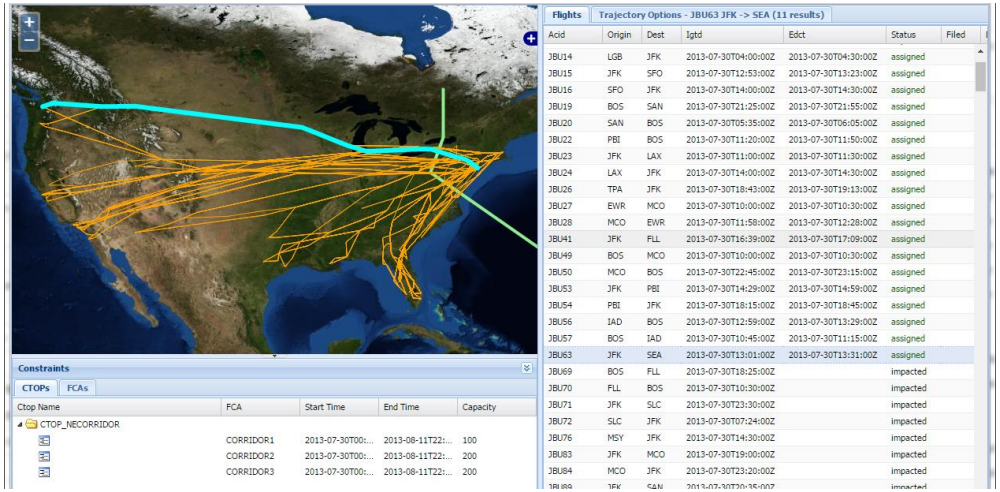






- Applies stochastic forecast of SFO stratus clearing
- Identifies Ground Delay Program parameters that reduce unnecessary delays relative to historical performance

Collaborative Trajectory Options



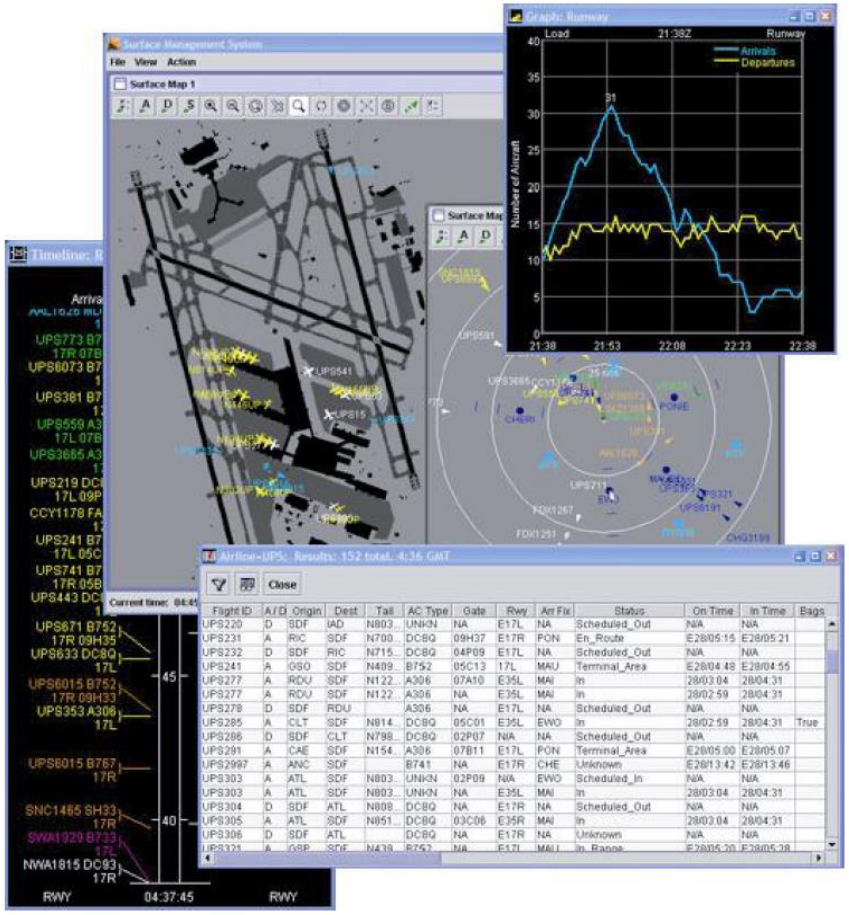
- Several Mosaic employees involved in CTOP early on
- CTOP SBIR in 2011 generated an airline CTOP decision aid and simulation, which was subsequently used in global ATM work
- New CTOP NRA about to start, may help further develop parts of CTOP that have kept it from reaching its potential

SWIM Standards Development

- The FAA is transitioning all data exchange to SWIM
- Mosaic ATM has been working with SWIM since 2012
- A significant part of Mosaic ATM's work is development of data standards for future FAA and international SWIM releases
- Our products anticipate and benefit from upcoming changes

Surface Decision Support System

- "TBFM for surface/departures"
- Research platform used by FAA and NASA for >15 years
- Invented by Mosaic ATM staff and developed/maintained by Mosaic ATM since 2004
- Operates 24x7x365 at several airports
- Backbone of NASA's ATD-2 demonstration

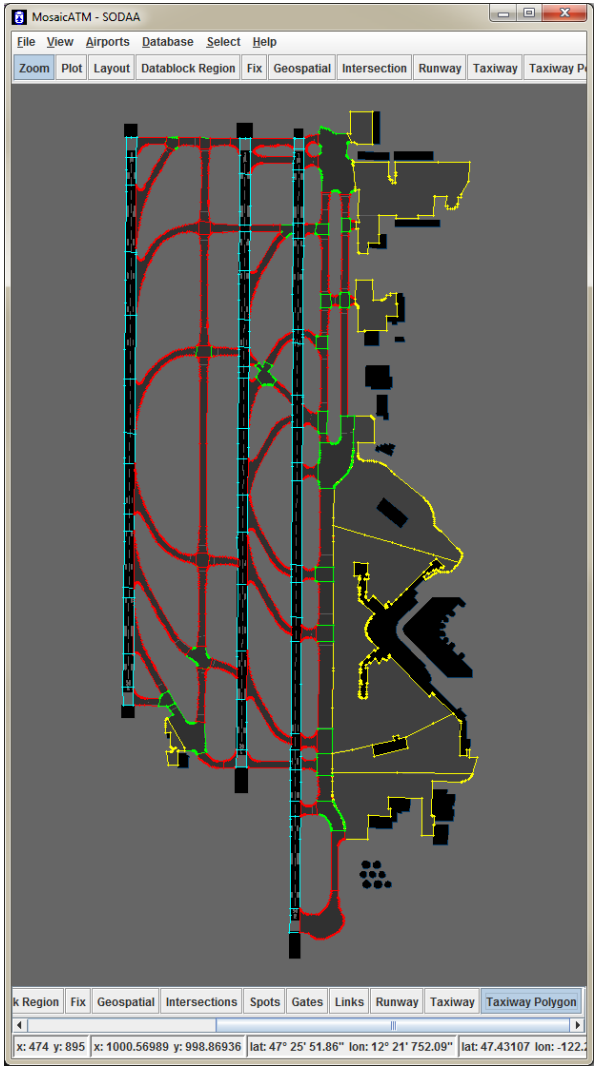


Key Sauce

- At the heart of our tools is fast-time simulation.
  - Identify current situation
    - Which aircraft is where?
    - Where is it going?
    - Applies at gate, on ramp, in the air, elsewhere.
  - Predict how situation will evolve.
    - Mosaic Prediction Engine (MPE) – algorithms that predict what will happen, given operating procedures, resource capacity, etc;
    - Adaptation – configuration data that describe to MPE the airports, airspace, operating procedures, capacities, etc.

Adaptation

- Physical elements needed prior precursor to analysis
  or simulation
  - Airport base map
  - Links
  - Gates
  - Spots
  - Runways
  - Taxiways polygons
  - Arrival / departure fixes
- Procedural elements
  - Airport and airspace configurations
  - Runway assignment rules
  - Gate assignment rules
  - Taxi rules
  - Etc



Current Commercial Products

- Mosaic Situation Viewer (MSV)
- Collaborative Trajectory Options Program (CTOP) Decision Aid
- Analytics Suite
- All built on common cloud-based infrastructure – SWIM Gateway

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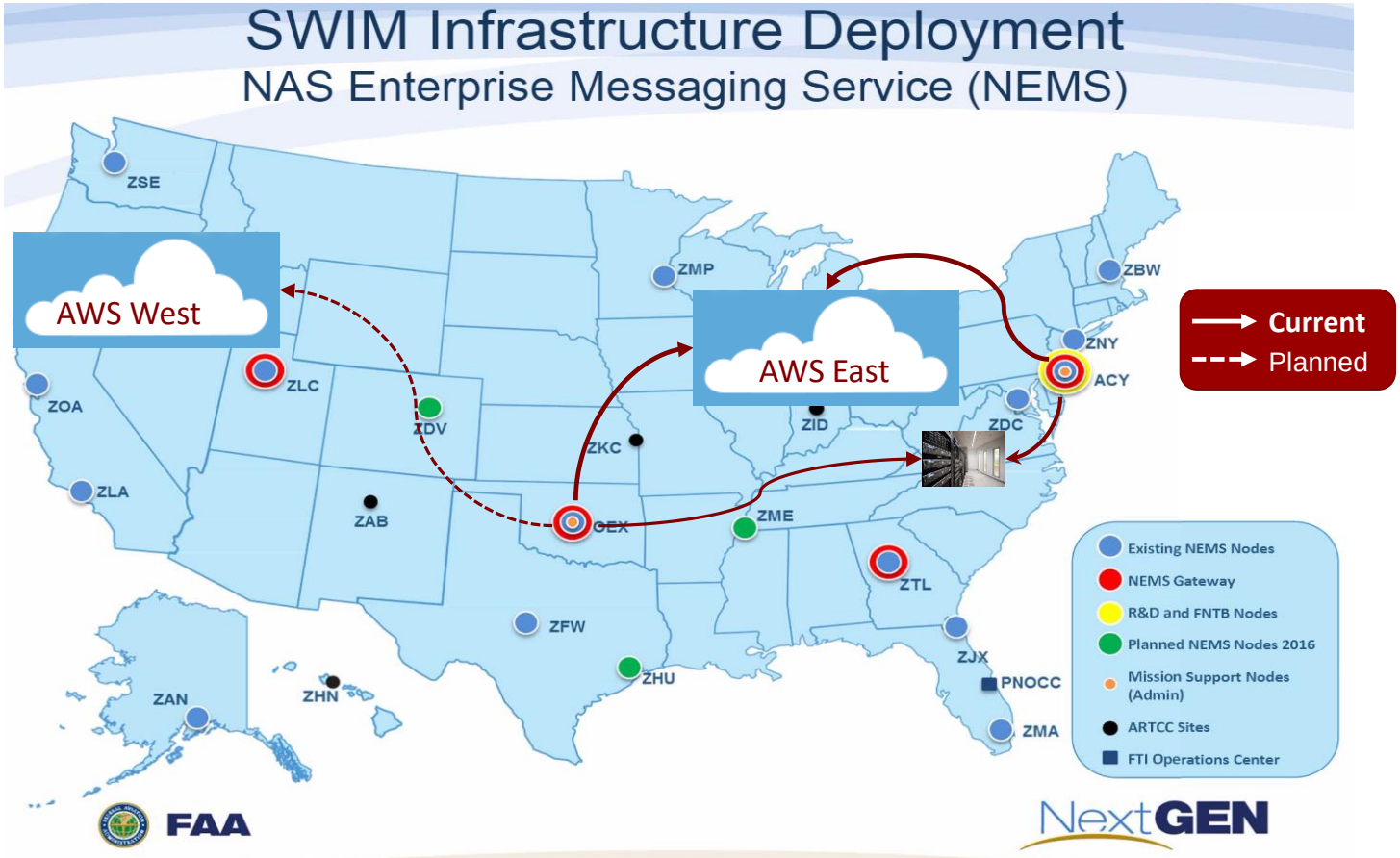
SWIM Gateway

- Mosaic ATM has been a pioneer in surface and airborne flight tracking and matching with hosted connections to ASDE-X, ARTS, STARS, ETMS, ASDI systems since 2004.

- Mosaic ATM has been an early adopter of FAA SWIM Services
  - Starting with research services originally deployed on the FTI National Test Bed in 2012
  - In February 2015 we transitioned to operational SWIM (STDDS) services
  - Today we have access to most/all publicly available operational SWIM services

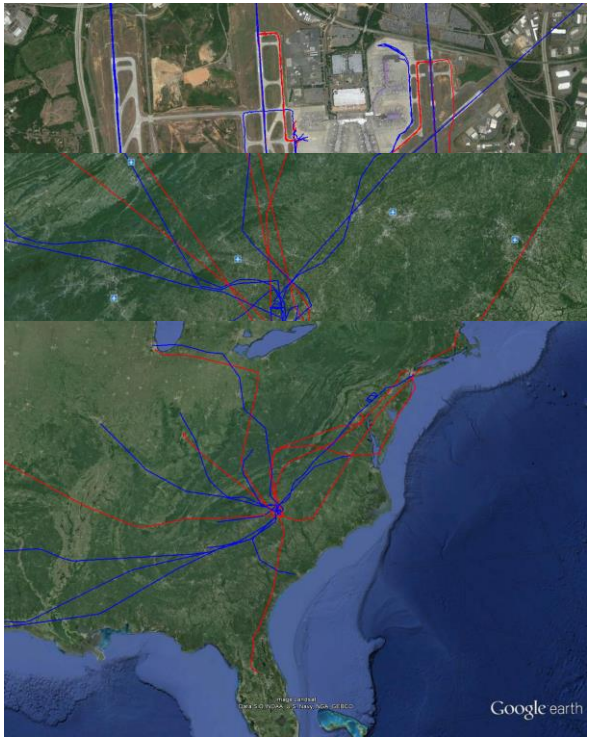
- Access to two NEMS Gateways connecting to:
  - R&D for developing against new services as they come online
  - FNTB (FTI National Test Bed) for certifying access to services
  - OPs for accessing operation services

Connectivity to FAA SWIM



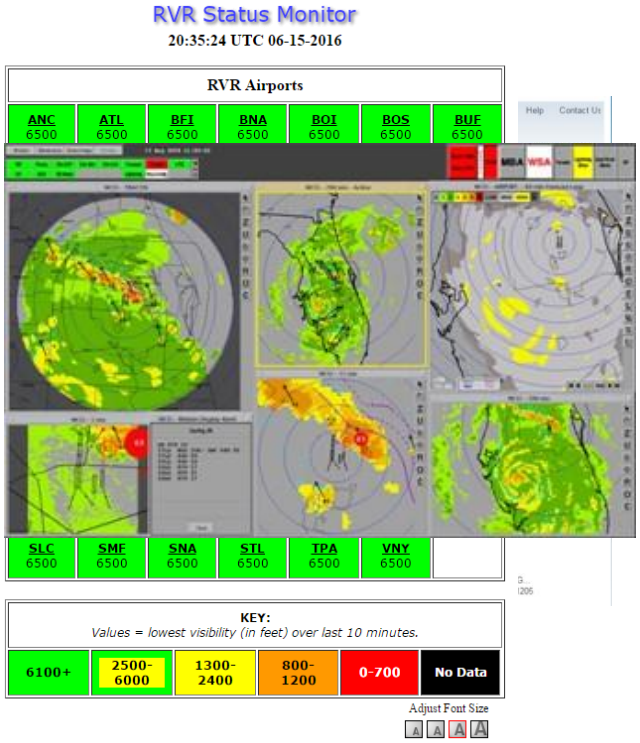
FAA SWIM Services

- Flight and Surveillance
  - SWIM Terminal Data Distribution System (**STDDS**) Surface Movement Event Service (**SMES**) sends derived surface movement events for all aircraft monitored at select towers. In addition- the service sends track positions for all aircraft and vehicles as well as generic flight plan data collected from towers associated with a Terminal Radar Approach Control. This service publishes position reports and surface movement events. *(36 Sites - Live ~1 sec updates)*
  - SWIM Terminal Data Distribution System (**STDDS**) Terminal Automation Information Service (**TAIS**) • publishes operational live flight plan data, track data, sign-in / sign-out (SISO) data, alert data, Instrument Meteorological Conditions (IMC) data, traffic count data, and performance monitoring data from the Standard Terminal Automation Replacement System (STARS). *(105 TRACONS FY16 - Live ~5 sec updates)*
  - En Route Flight and Related Data or SWIM Flight Data Publication Service (**SFDPS**) • Proposed and active flight plans, including amendment information; track data associated with active flights; and arrival, departure, and cancellation information. *(NAS Wide - Currently Live 1 min updates transitioning to 11 sec updates fall 2016)*
  - Traffic Flow Management System (**TFMS**) Flight Data • Flight Plan Data, Departure & Arrival time notifications, Flight cancellations, Boundary crossings, and Track position reports. *(NAS Wide - Live 1 min updates)*



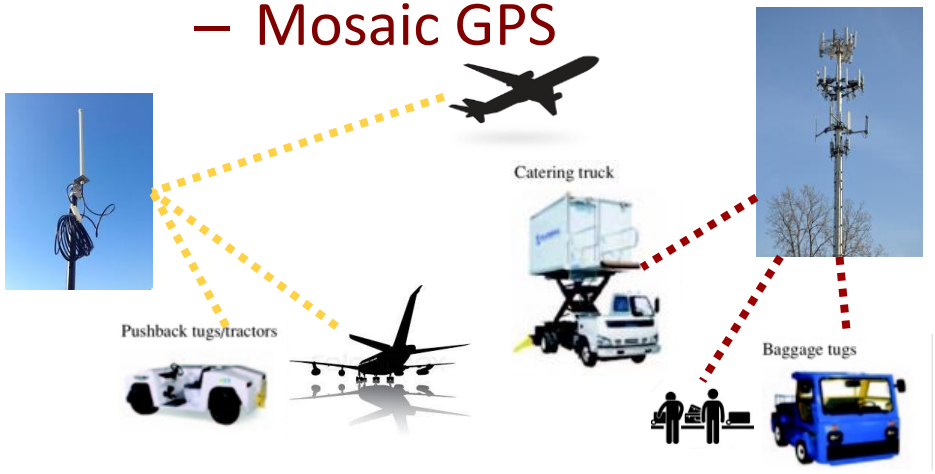
FAA SWIM Services - Continued

- Status and Constraint
  - Traffic Flow Management System (**TFMS**) Flow Information All Traffic Management Initiative (TMI) definitions, Air Traffic Control System Command Center (ATCSCC) advisories, Restrictions, Airport runway configuration and rates, Airport deicing status
  - Federal NOTAM System Distribution Service (**FNS-NDS**) provides the current digital (Aeronautical Information Exchange Model data format) and non-digital NOTAM messages
  - SWIM Terminal Data Distribution System (**STDDS**) Airport Data Service (**APDS**) publishes Runway Visual Range (RVR) data to consumers. Data includes runway visibility and trend for touchdown, midpoint and roll-out, depending on the instrumentation for the runway. Data also includes edge and center-line light intensity settings.
  - Integrated Terminal Weather System (**ITWS**) data services provides clients with a common interface to subscribe to a variety of weather products.



NON-FAA Sources

- Surveillance
  - External/Third-party ADS-B (new option)
  - Mosaic ADS-B (2014)
  - Mosaic GPS

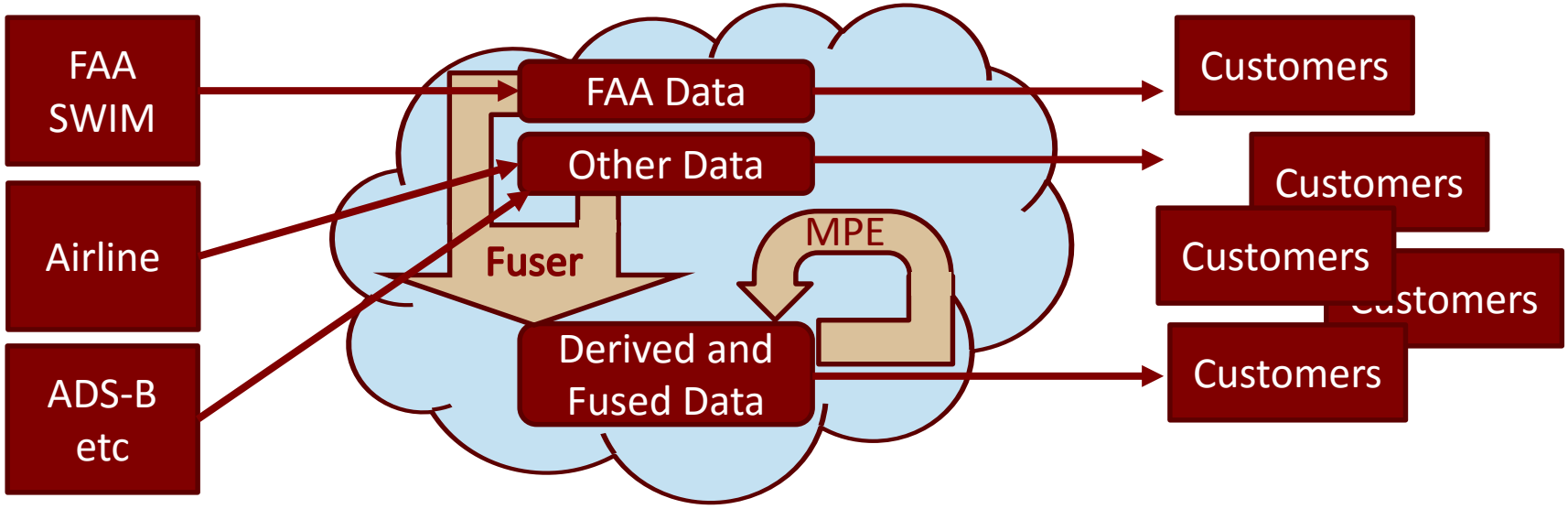


- Airline
  - Flight Data
  - Gate Data

Washington to Charlotte
Thursday, June 16, 2016

Flight	Depart	Arrive
	Actual	Estimated
5399 American Airlines Operated by PSA Airlines as American Eagle	5:12 AM IAD	6:40 AM CLT
In flight	Scheduled: 5:15 AM Terminal: -- Gate: B71	Scheduled: 6:35 AM Terminal: -- Gate: E22 Baggage: E

SWIM Gateway



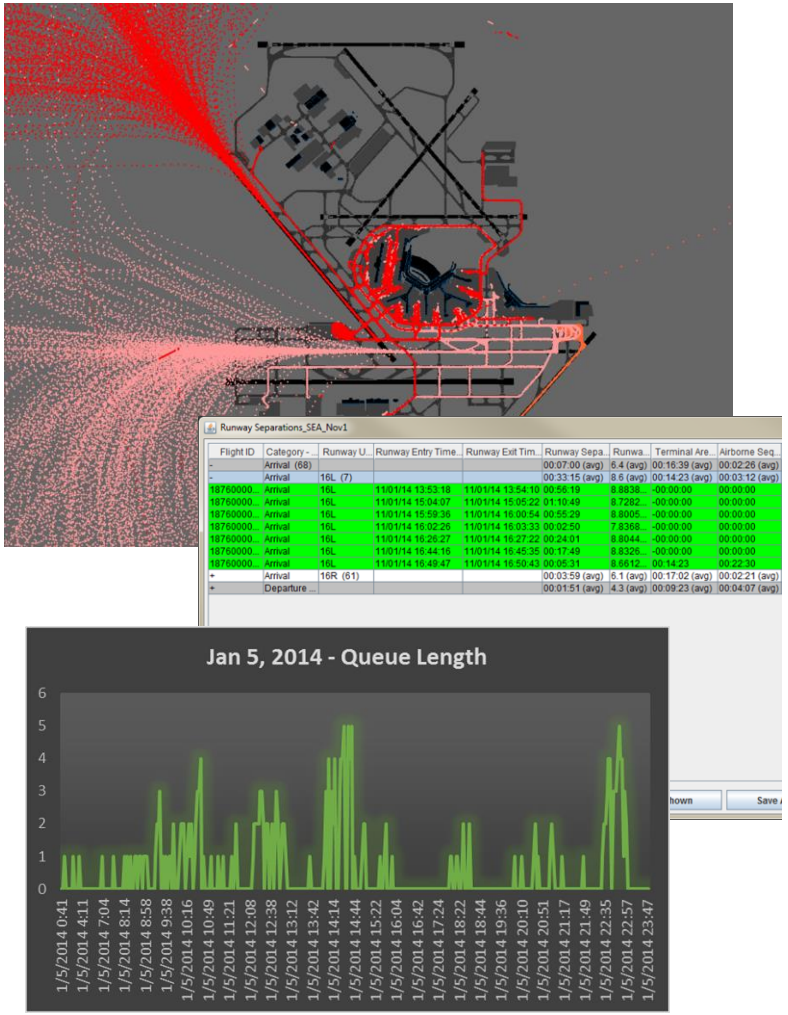
- SWIM Gateway
  - Collects data from SWIM and other sources
  - Fuses disparate sources into consistent picture
  - Publishes results to customers and Mosaic apps

Current Commercial Products

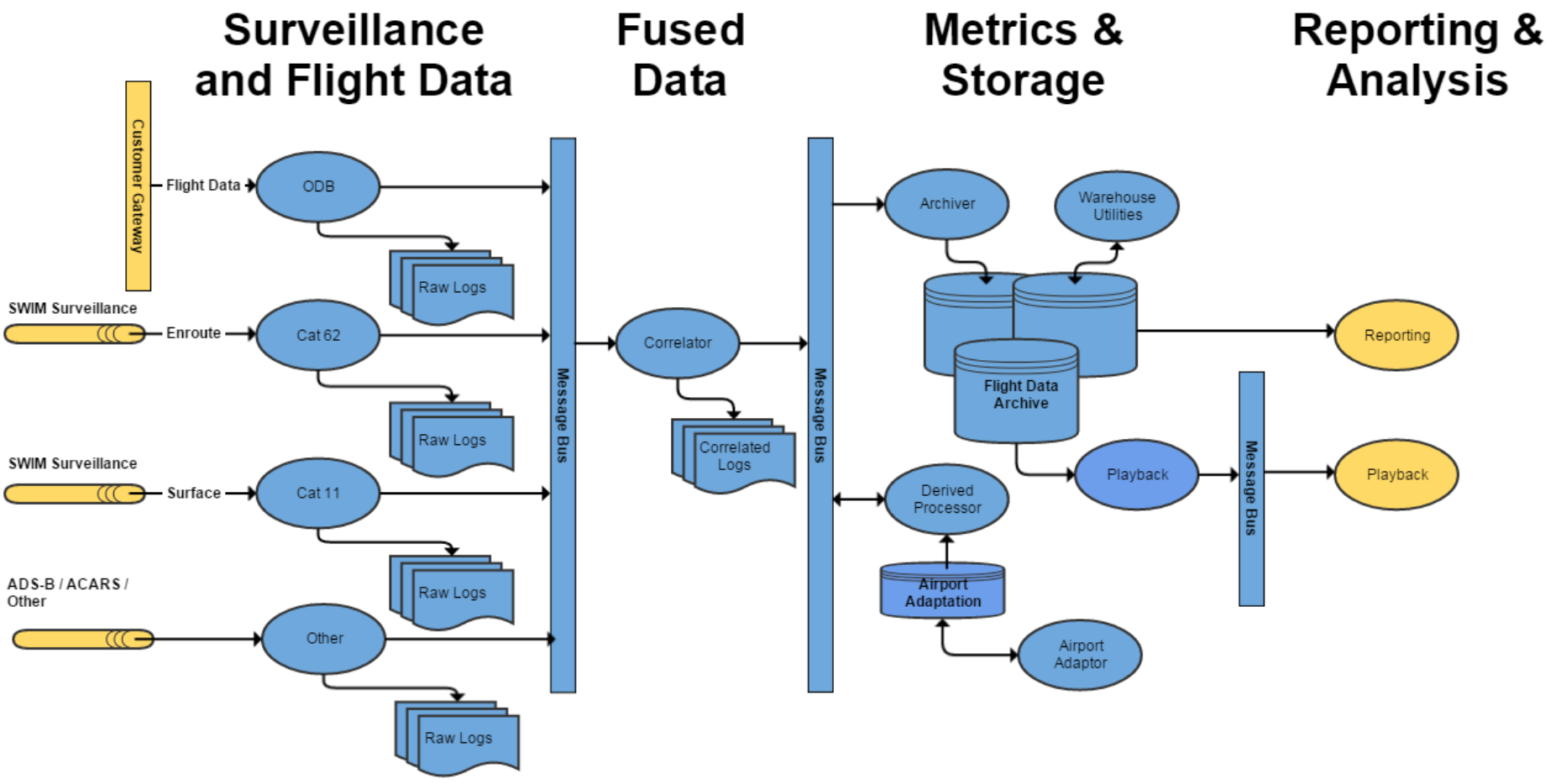
- Mosaic Situation Viewer (MSV)
- Collaborative Trajectory Options Program (CTOP) Decision Aid
- Analytics Suite
- All built on common cloud-based infrastructure – SWIM Gateway

Analytics

- The Analytics Suite Provides:
  - Fused flight data integrating multiple data sources to create a more complete picture of flight operations.
    - Integrating Surface, TRACON, and En Route sources that provide surveillance and flight planning information
  - Data Management
    - On-line data warehouse to simplify flight data access
  - Key Performance Indicators (KPIs)
    - Flight level metrics capturing flight, airport and airspace performance.
  - Data Mining Tools to Identify
    - Airport and Airspace metrics categorized by attribute and resource.
    - Grouping, graphing, flight track plotting and playback.

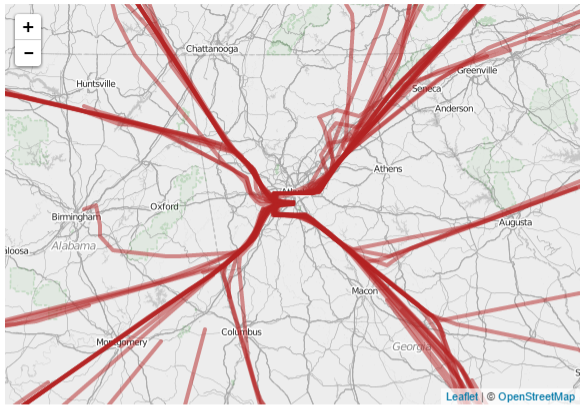


Mosaic Analytics Architecture

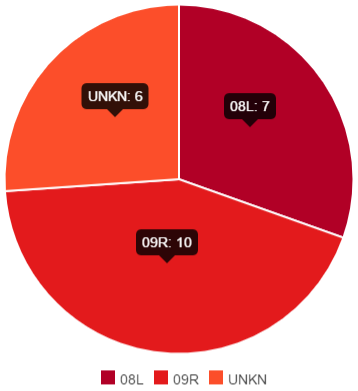


Graphical Reporting Capabilities

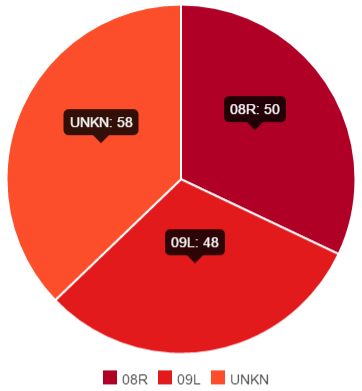
Active Inbound Tracks - ATL



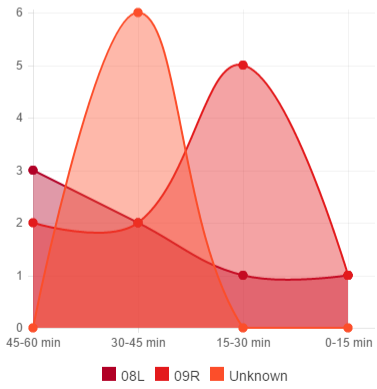
Arrival Runway Usage (Last Hour)



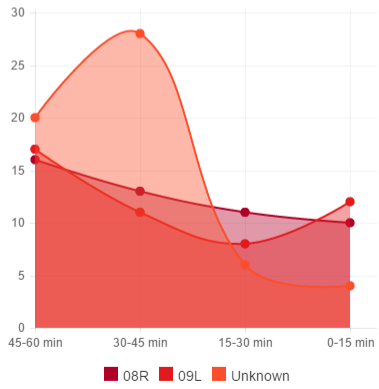
Departure Runway Usage (Last Hour)



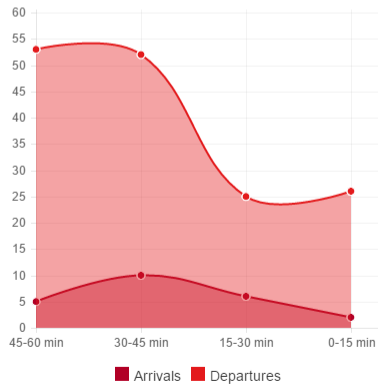
Arrival Runway Usage



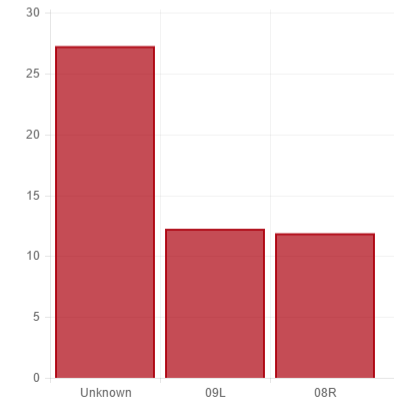
Departure Runway Usage



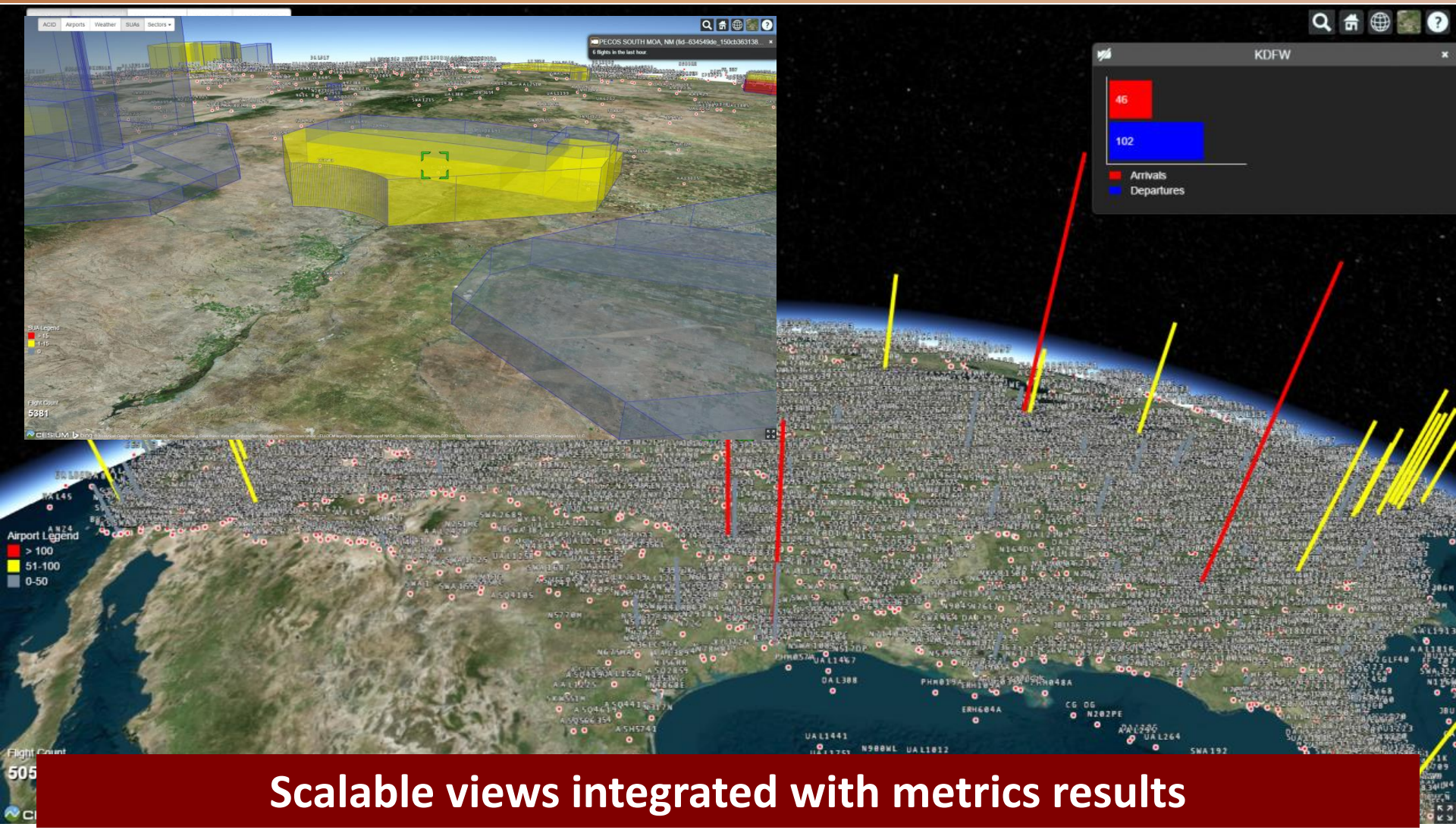
Airport Traffic by Operation (Last Hour)



Average Departure Taxi Time by Runway



Graphical Reporting Capabilities



Scalable views integrated with metrics results

Questions

- Show of hands:
  - Who has questions that need data to answer?
  - Do you have a group in-house who uses Analytics tools?
  - Do you rely on external analyses?

- What's your biggest unanswered operational question?

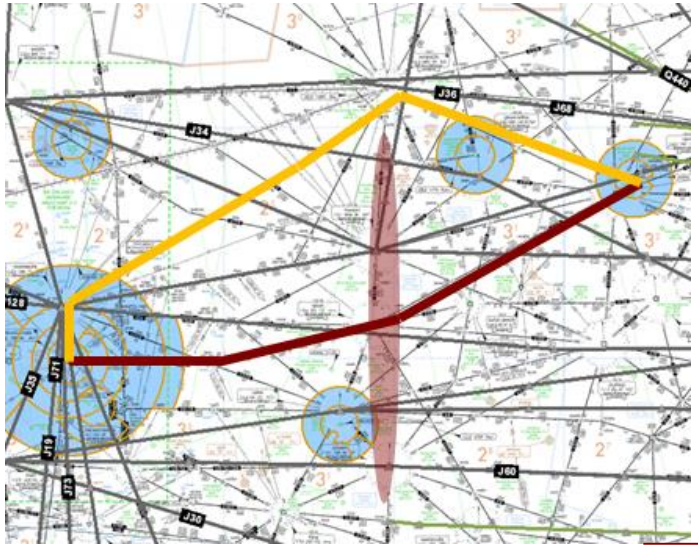
Current Commercial Products

- Mosaic Situation Viewer (MSV)
- Collaborative Trajectory Options Program (CTOP) Decision Aid
- Analytics Suite
- All built on common cloud-based infrastructure – SWIM Gateway

CTOP

Without CTOP:

- FAA issues FCA's
- Flights going through FCA's take delay



With CTOP:

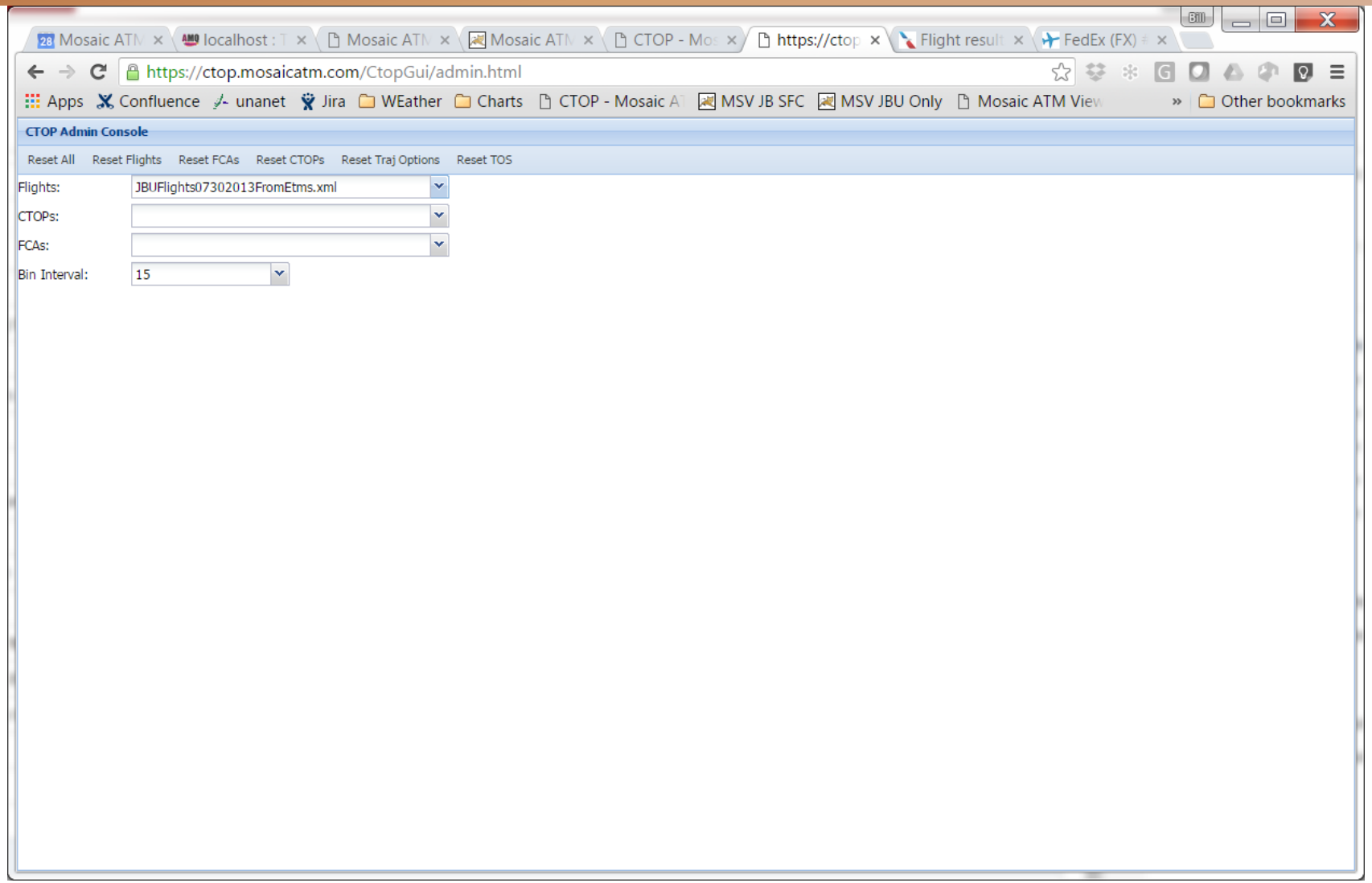
- FAA issues FCA's
- Flights are given the option to route around FCA's (extra fuel) or go through (delay)
- Operator can specify preferences in advance via Trajectory Options Set (TOS)

Interacting with CTOP

- To benefit from CTOP, users need to manage multiple routes, valid times, and preference information - RTC's – comprising the Trajectory Options Set (TOS)
- Dispatch is already busy
- The Mosaic ATM CTOP system interfaces with user and FAA systems to streamline the process and ensure user objectives are met

CTOP System Benefits

- The Mosaic ATM CTOP System squeezes advantage from CTOP's, yet requires very little workload
  - Unique ability to automatically generate route options appropriate to the FCA's
  - Calculates meaningful Relative Trajectory Cost (RTC) information for each trajectory option, based on flight-specific information
  - Manage the process by exception: monitor and guide with minimal workload
- It would be extremely difficult to do this well without the Mosaic ATM CTOP system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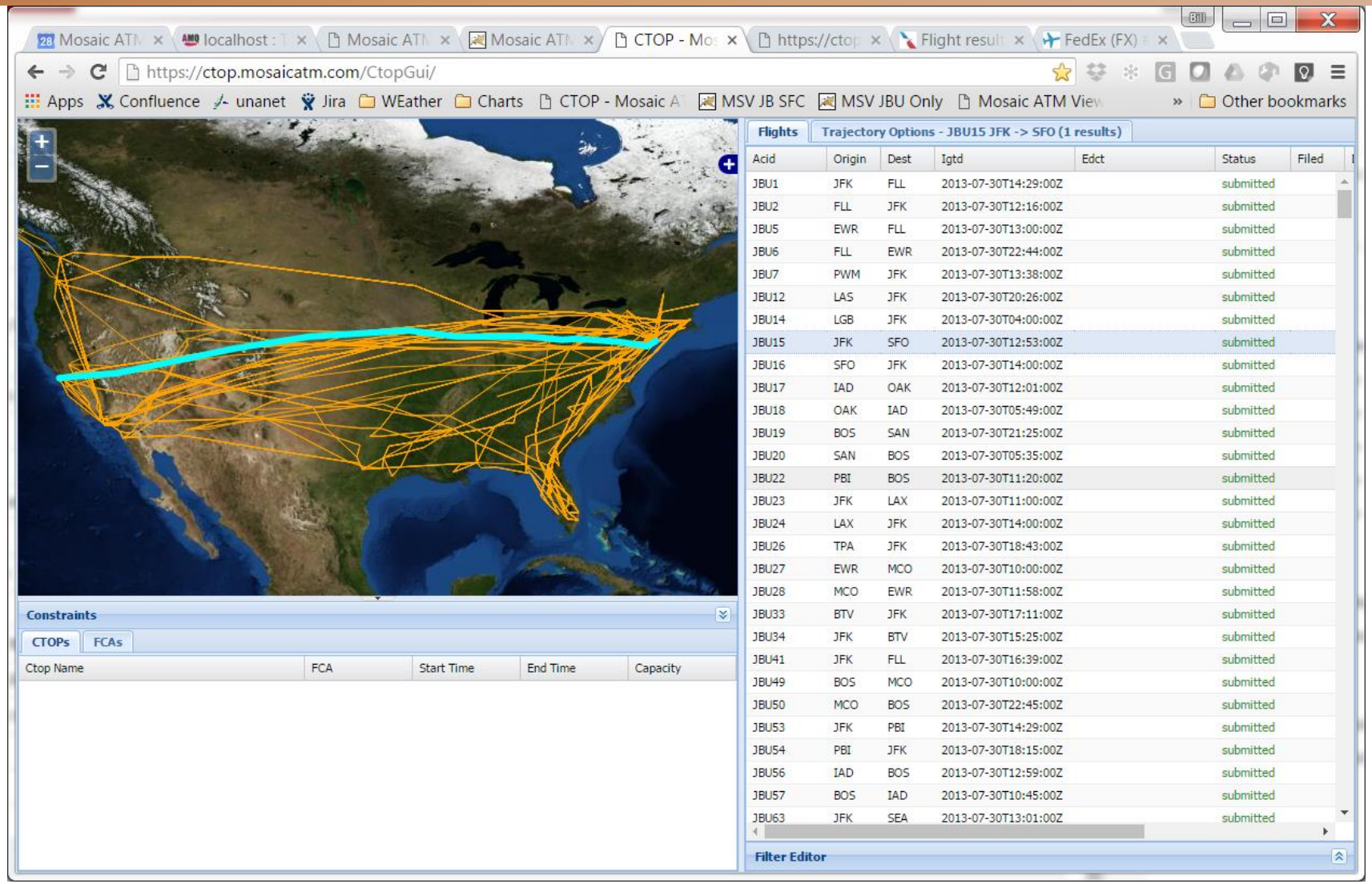
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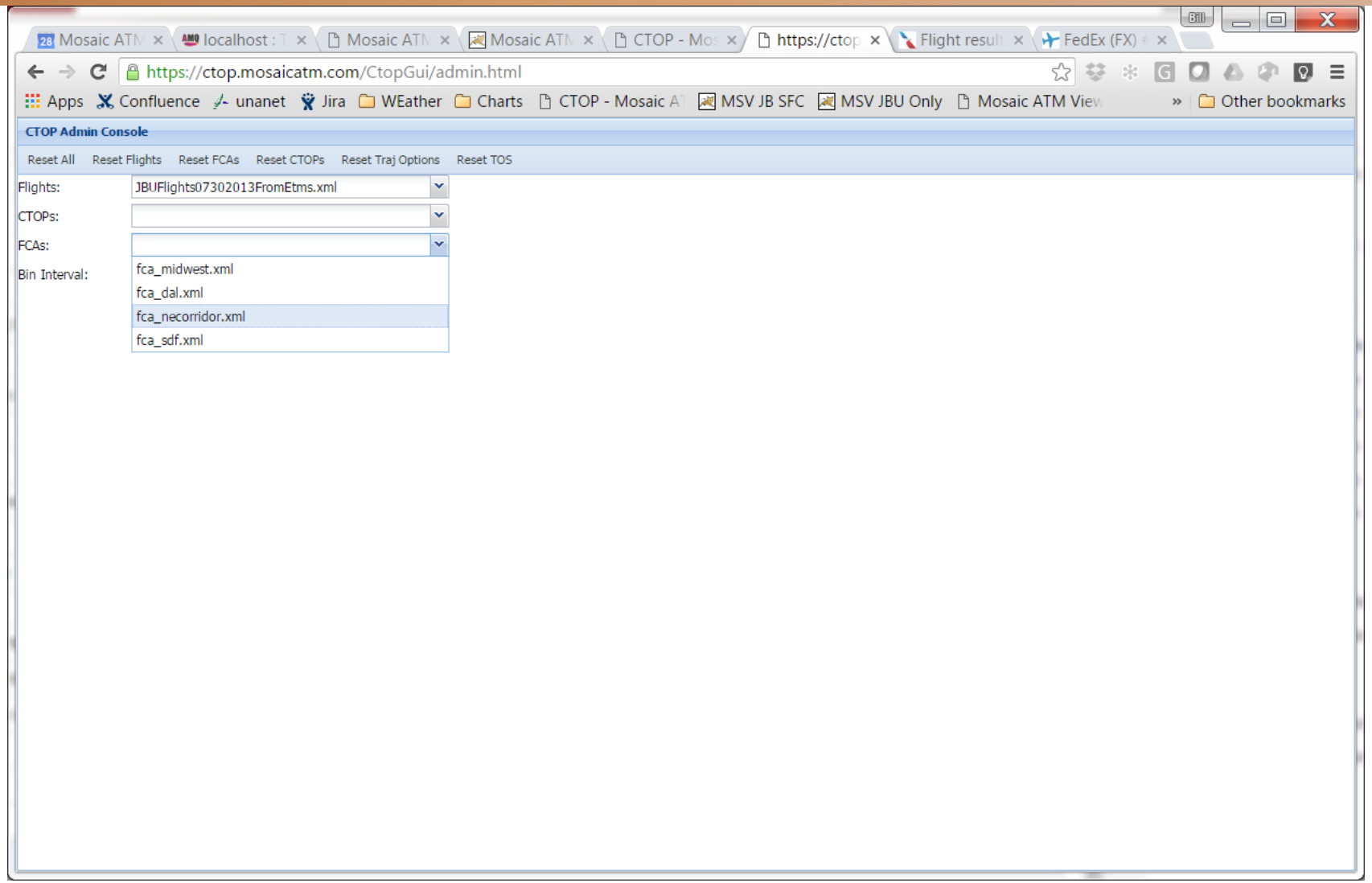
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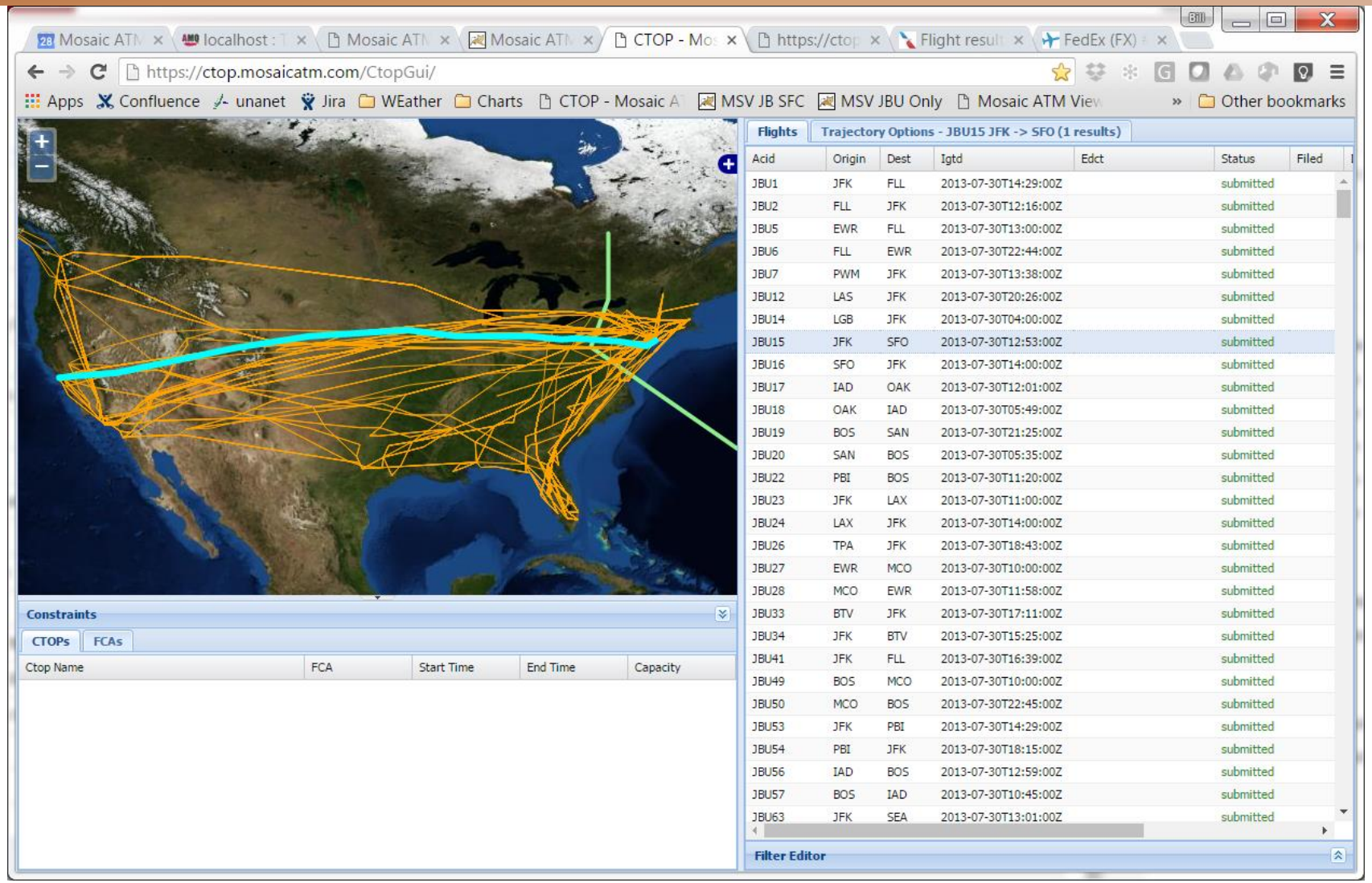
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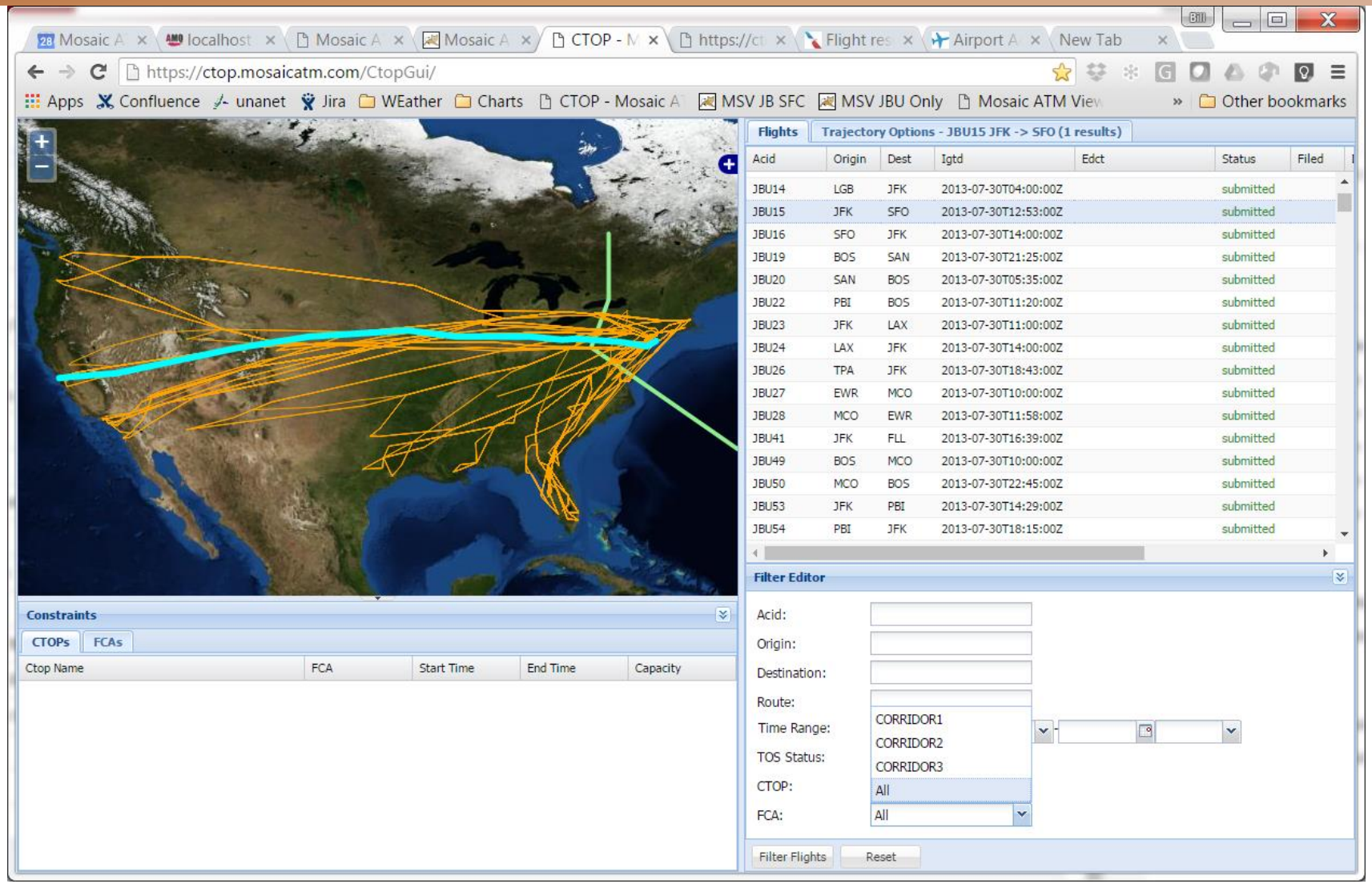
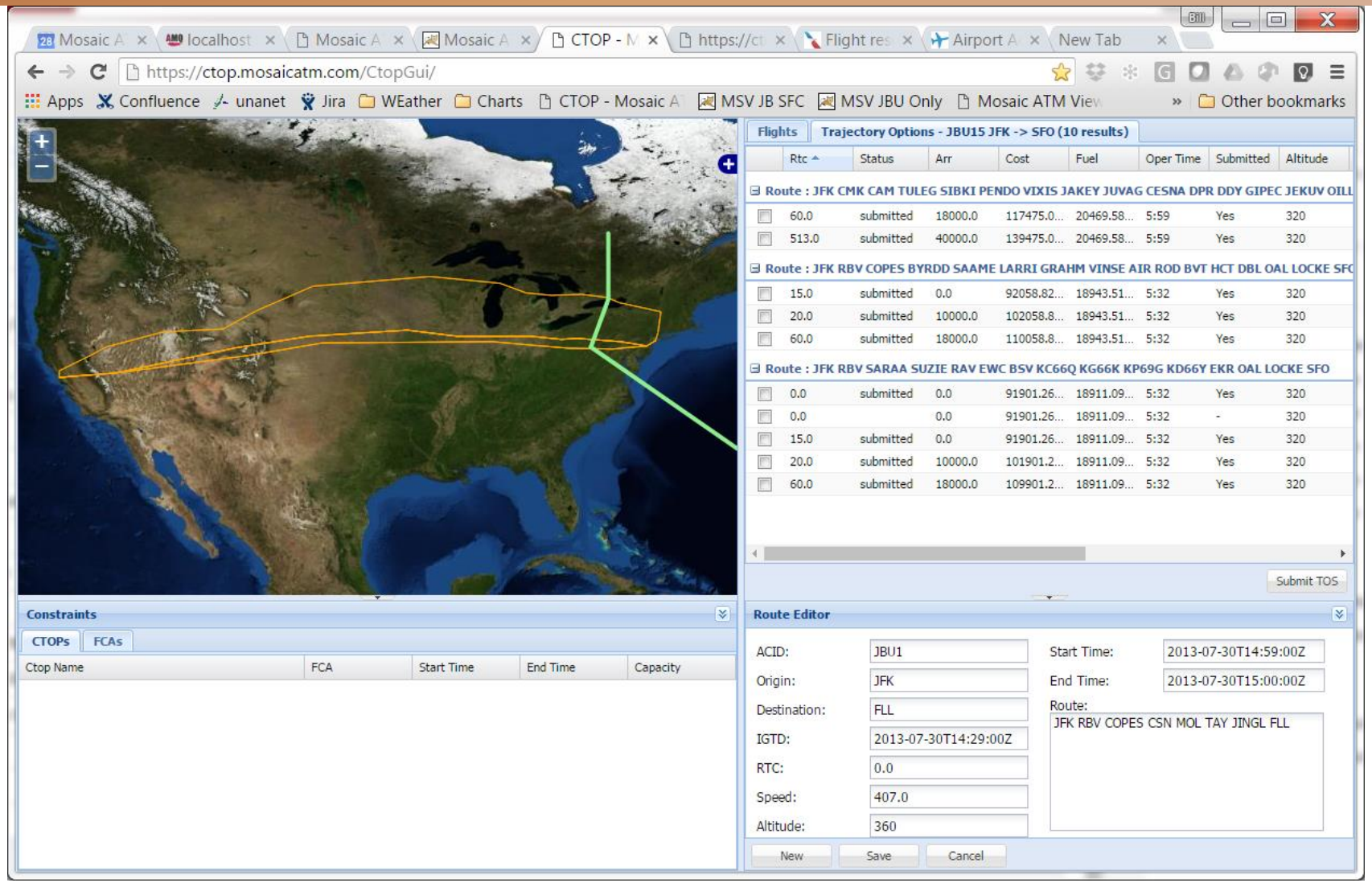
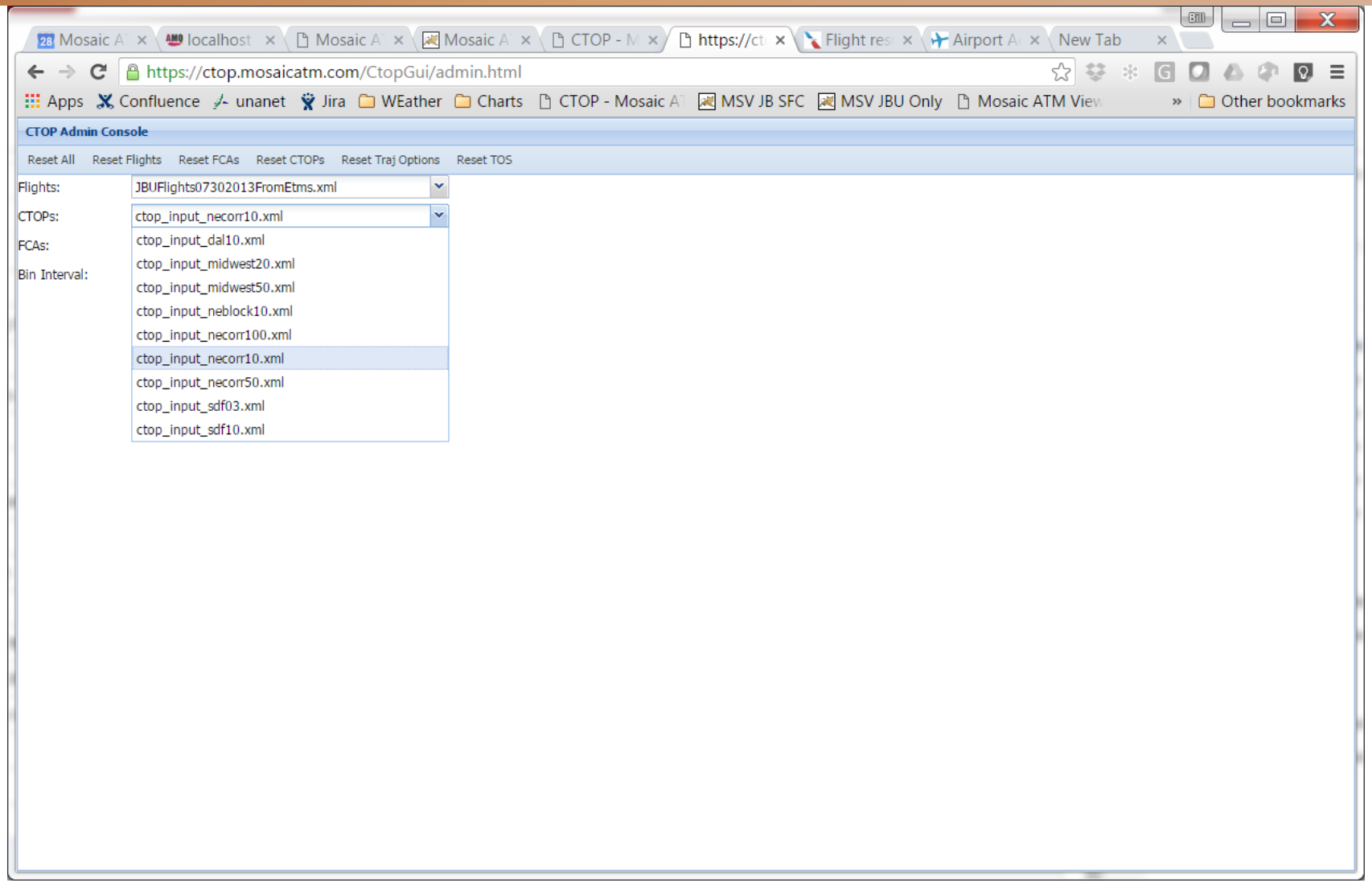
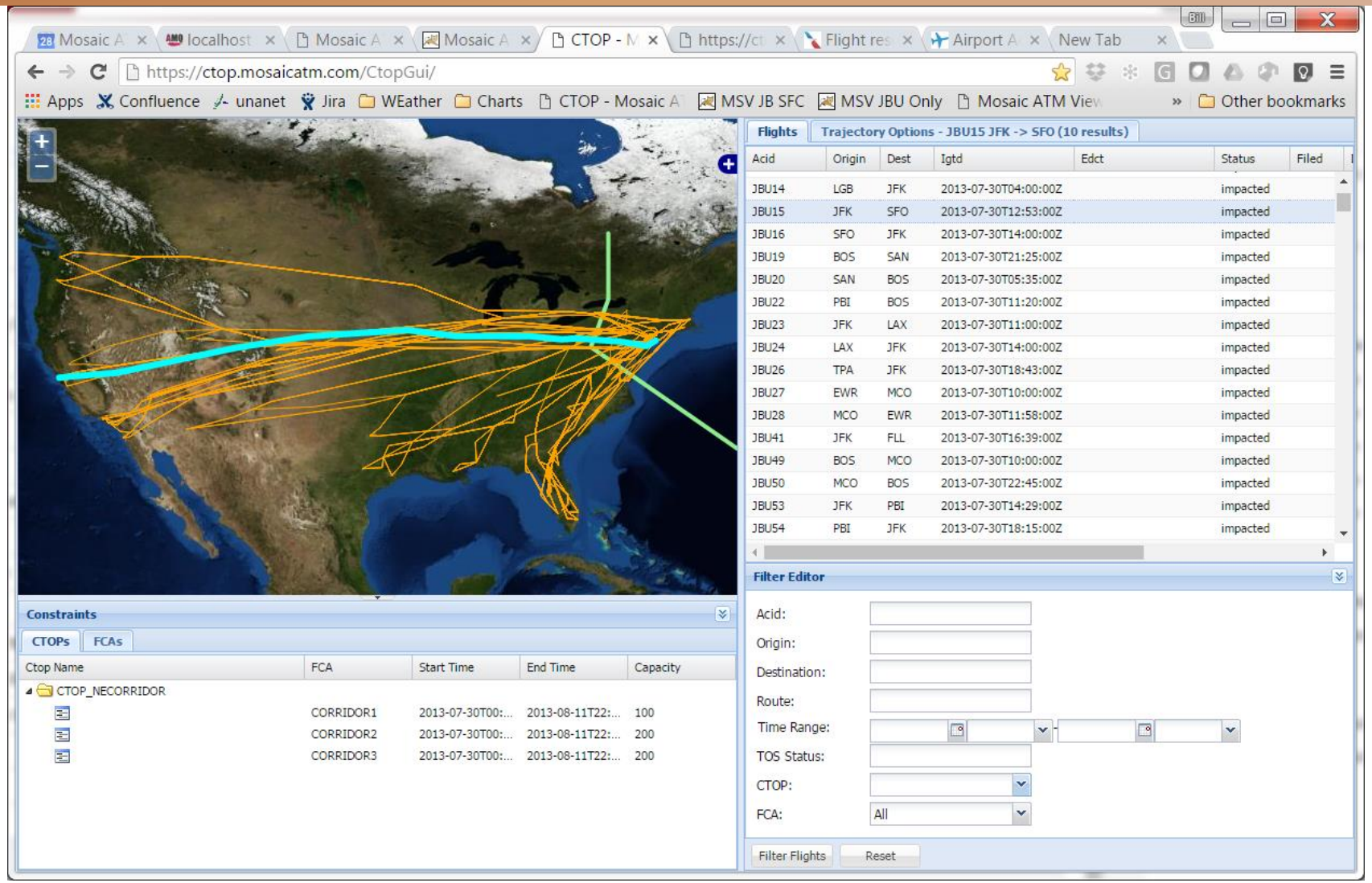
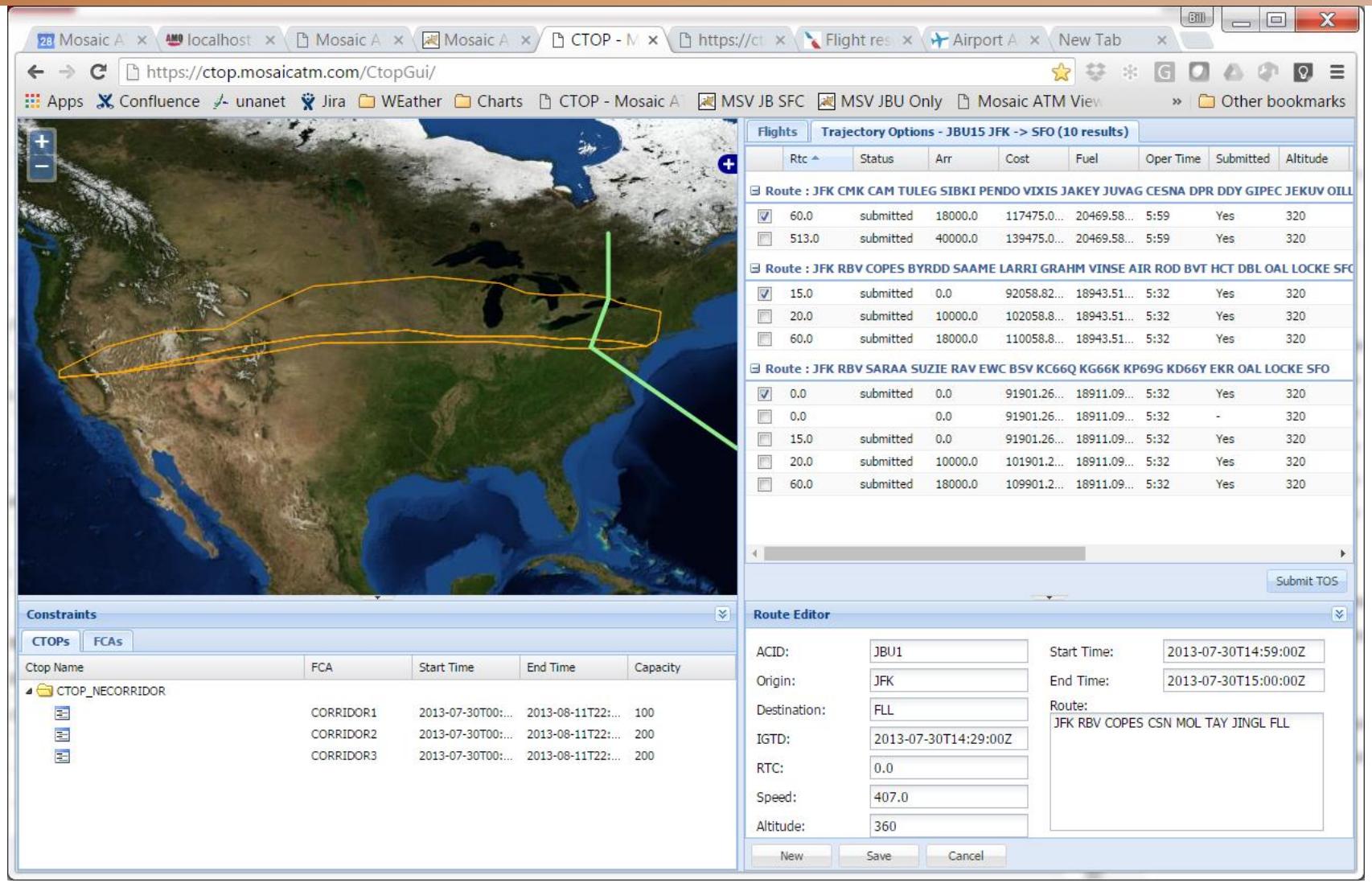
JBU16 SFO JFK 2013-07-30T14:00:00Z submitted
JBU17 IAD OAK 2013-07-30T12:01:00Z submitted
JBU18 OAK IAD 2013-07-30T05:49:00Z submitted
JBU19 BOS SAN 2013-07-30T21:25:00Z submitted
JBU20 SAN BOS 2013-07-30T05:35:00Z submitted
JBU22 PBI BOS 2013-07-30T11:20:00Z submitted
JBU23 JFK LAX 2013-07-30T11:00:00Z submitted
JBU24 LAX JFK 2013-07-30T14:00:00Z submitted
JBU26 TPA JFK 2013-07-30T18:43:00Z submitted
JBU27 EWR MCO 2013-07-30T10:00:00Z submitted
JBU28 MCO EWR 2013-07-30T11:58:00Z submitted
JBU33 BTV JFK 2013-07-30T17:11:00Z submitted
JBU34 JFK BTV 2013-07-30T15:25:00Z submitted
JBU41 JFK FLL 2013-07-30T16:39:00Z submitted
JBU49 BOS MCO 2013-07-30T10:00:00Z submitted
JBU50 MCO BOS 2013-07-30T22:45:00Z submitted
JBU53 JFK PBI 2013-07-30T14:29:00Z submitted
JBU54 PBI JFK 2013-07-30T18:15:00Z submitted
JBU56 IAD BOS 2013-07-30T12:59:00Z submitted
JBU57 BOS IAD 2013-07-30T10:45:00Z submitted
JBU63 JFK SEA 2013-07-30T13:01:00Z submitted
Filter Editor
Constraints
CTOPs
FCAs
Ctop Name FCA Start Time End Time Capacity

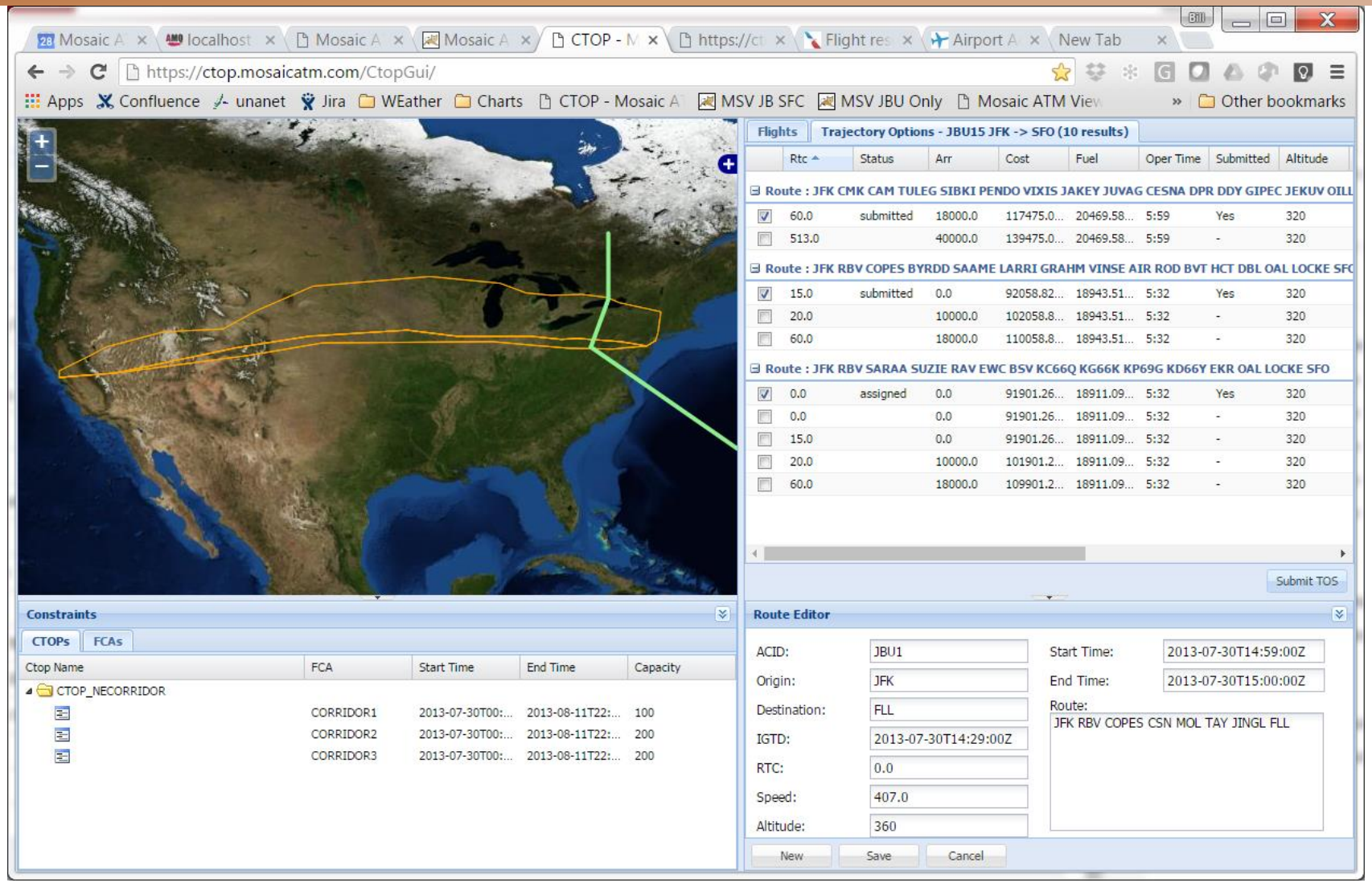

https://ctop.mosaicatm.com/CtopGui/
Apps
Confluence
unanet
Jira
WEather
Charts
CTOP - Mosaic A
MSV JB SFC
MSV JBU Only
Mosaic ATM Vie
Other bookmarks
Flights
Trajectory Options - JBU15 JFK -> SFO (1 results)
Acid
Origin
Dest
Igtd
Edct
Status
Filed
JBU14 LGB JFK 2013-07-30T04:00:00Z submitted
JBU15 JFK SFO 2013-07-30T12:53:00Z submitted
JBU16 SFO JFK 2013-07-30T14:00:00Z submitted
JBU19 BOS SAN 2013-07-30T21:25:00Z submitted
JBU20 SAN BOS 2013-07-30T05:35:00Z submitted
JBU22 PBI BOS 2013-07-30T11:20:00Z submitted
JBU23 JFK LAX 2013-07-30T11:00:00Z submitted
JBU24 LAX JFK 2013-07-30T14:00:00Z submitted
JBU26 TPA JFK 2013-07-30T18:43:00Z submitted
JBU27 EWR MCO 2013-07-30T10:00:00Z submitted
JBU28 MCO EWR 2013-07-30T11:58:00Z submitted
JBU41 JFK FLL 2013-07-30T16:39:00Z submitted
JBU49 BOS MCO 2013-07-30T10:00:00Z submitted
JBU50 MCO BOS 2013-07-30T22:45:00Z submitted
JBU53 JFK PBI 2013-07-30T14:29:00Z submitted
JBU54 PBI JFK 2013-07-30T18:15:00Z submitted
Filter Editor
Acid:
Origin:
Destination:
Route:
Time Range:
TOS Status:
CTOP:
FCA:
CORRIDOR1
CORRIDOR2
CORRIDOR3
All
All
Filter Flights
Reset
Constraints
CTOPs
FCAs
Ctop Name
FCA
Start Time
End Time
Capacity

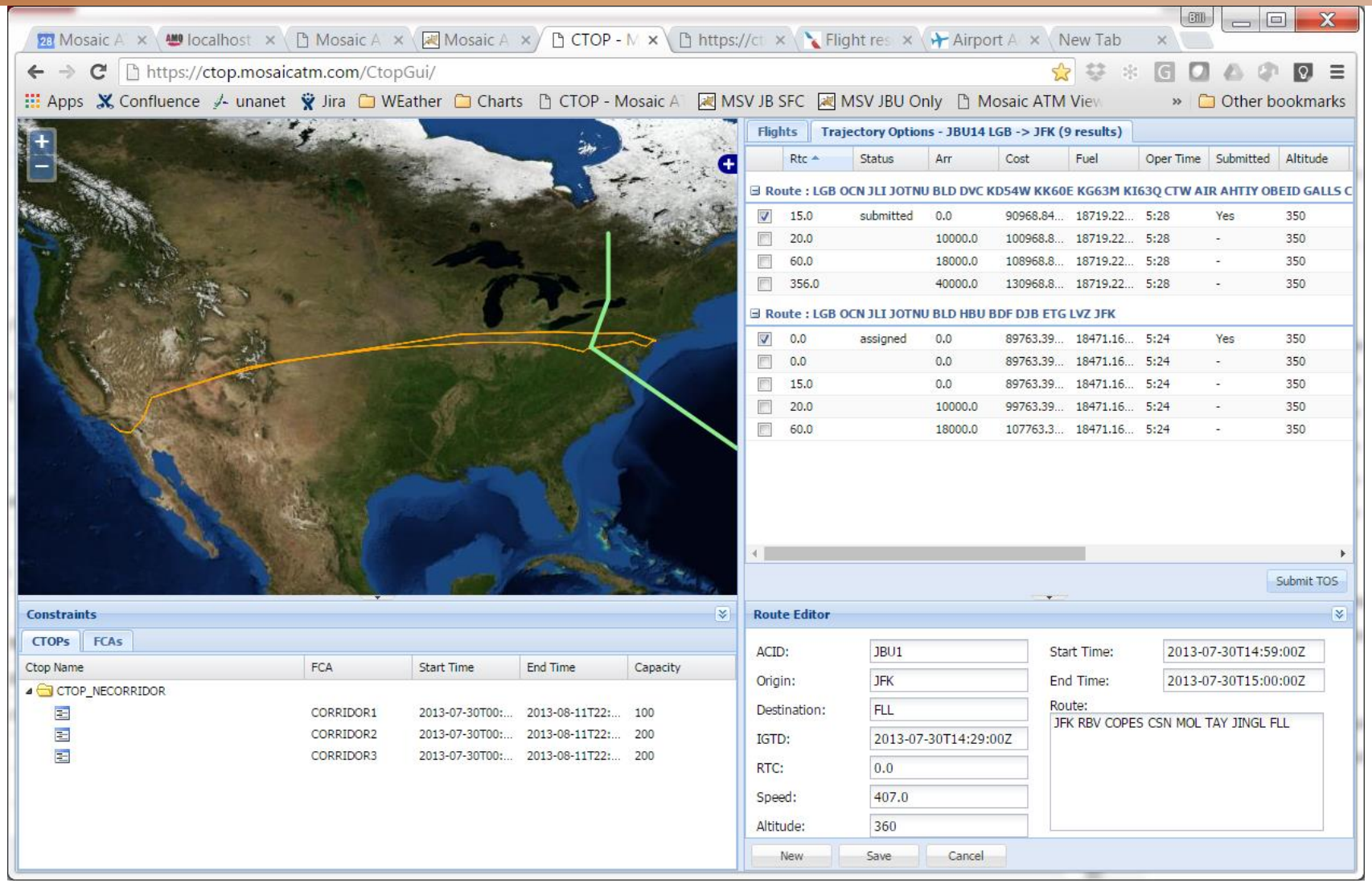

https://ctop.mosaicatm.com/CtopGui/
Apps
Confluence
unanet
Jira
WEather
Charts
CTOP - Mosaic A
MSV JB SFC
MSV JBU Only
Other bookmarks
Flights
Trajectory Options - JBU15 JFK -> SFO (10 results)
Rtc
Status
Arr
Cost
Fuel
Oper Time
Submitted
Altitude
Route : JFK CMK CAM TULEG SIBKI PENDO VIXIS JAKEY JUVAG CESNA DPR DDY GIPEC JEKUV OILL
60.0 submitted 18000.0 117475.0... 20469.58... 5:59 Yes 320
513.0 submitted 40000.0 139475.0... 20469.58... 5:59 Yes 320
Route : JFK RBV COPES BYRDD SAAME LARRI GRAHM VINSE AIR ROD BVT HCT DBL OAL LOCKE SFO
15.0 submitted 0.0 92058.82... 18943.51... 5:32 Yes 320
20.0 submitted 10000.0 102058.8... 18943.51... 5:32 Yes 320
60.0 submitted 18000.0 110058.8... 18943.51... 5:32 Yes 320
Route : JFK RBV SARAA SUZIE RAV EWC BSV KC66Q KG66K KP69G KD66Y EKR OAL LOCKE SFO
0.0 submitted 0.0 91901.26... 18911.09... 5:32 Yes 320
0.0 0.0 91901.26... 18911.09... 5:32 - 320
15.0 submitted 0.0 91901.26... 18911.09... 5:32 Yes 320
20.0 submitted 10000.0 101901.2... 18911.09... 5:32 Yes 320
60.0 submitted 18000.0 109901.2... 18911.09... 5:32 Yes 320
Submit TOS
Constraints
CTOPs
FCAs
Ctop Name
FCA
Start Time
End Time
Capacity
Route Editor
ACID: JBU1
Origin: JFK
Destination: FLL
IGTD: 2013-07-30T14:29:00Z
RTC: 0.0
Speed: 407.0
Altitude: 360
Start Time: 2013-07-30T14:59:00Z
End Time: 2013-07-30T15:00:00Z
Route:
JFK RBV COPES CSN MOL TAY JINGL FLL
New
Save
Cancel

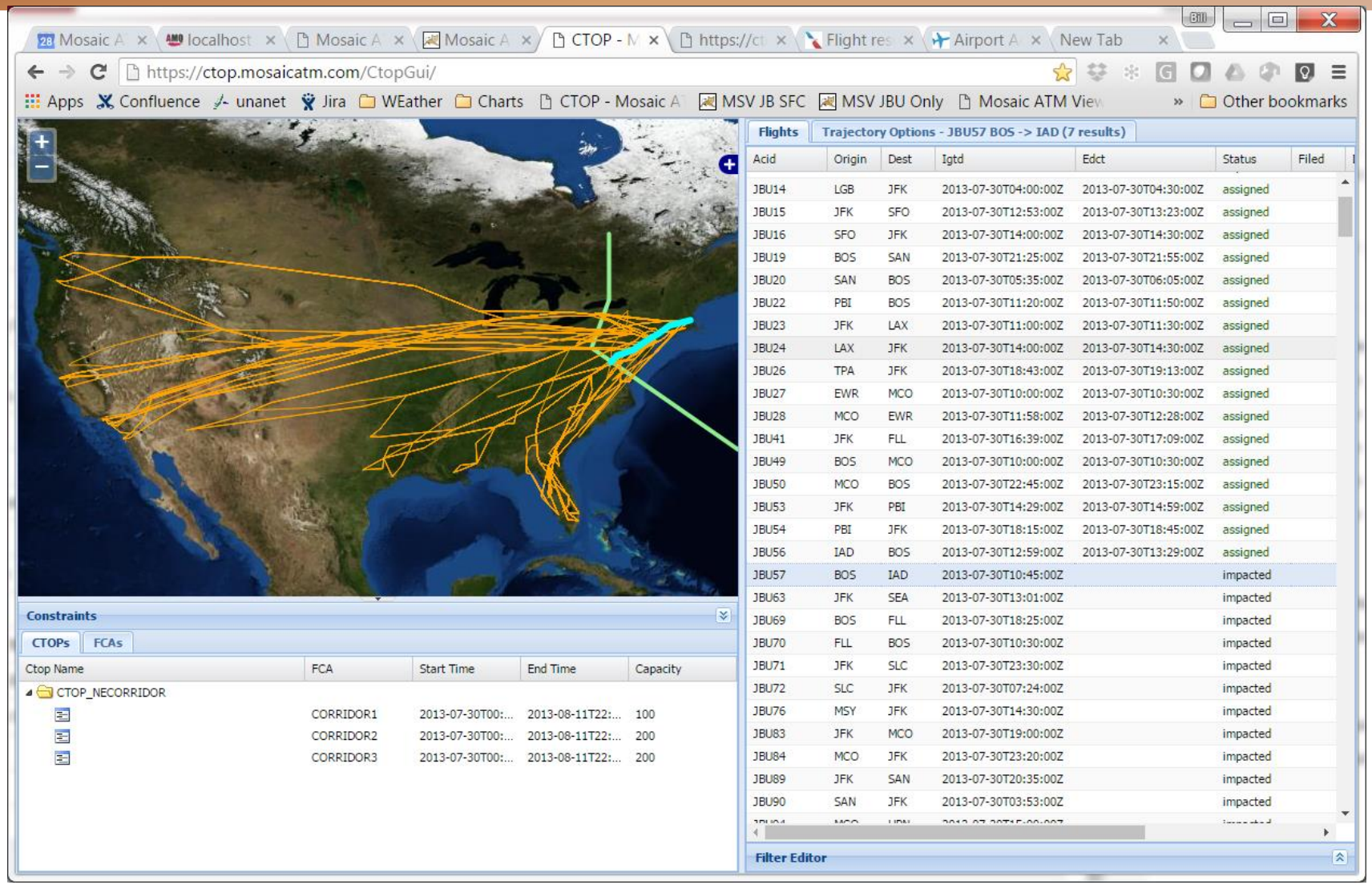

https://ctop.mosaicatm.com/CtopGui/admin.html
Apps
Confluence
unanet
Jira
WEather
Charts
CTOP - Mosaic A
MSV JB SFC
MSV JBU Only
Mosaic ATM Vie
Other bookmarks
CTOP Admin Console
Reset All
Reset Flights
Reset FCAs
Reset CTOPs
Reset Traj Options
Reset TOS
Flights:
JBUFlights07302013FromEtms.xml
CTOPs:
ctop_input_necorr10.xml
FCAs:
Bin Interval:
ctop_input_dal10.xml
ctop_input_midwest20.xml
ctop_input_midwest50.xml
ctop_input_neblock10.xml
ctop_input_necorr100.xml
ctop_input_necorr10.xml
ctop_input_necorr50.xml
ctop_input_sdf03.xml
ctop_input_sdf10.xml

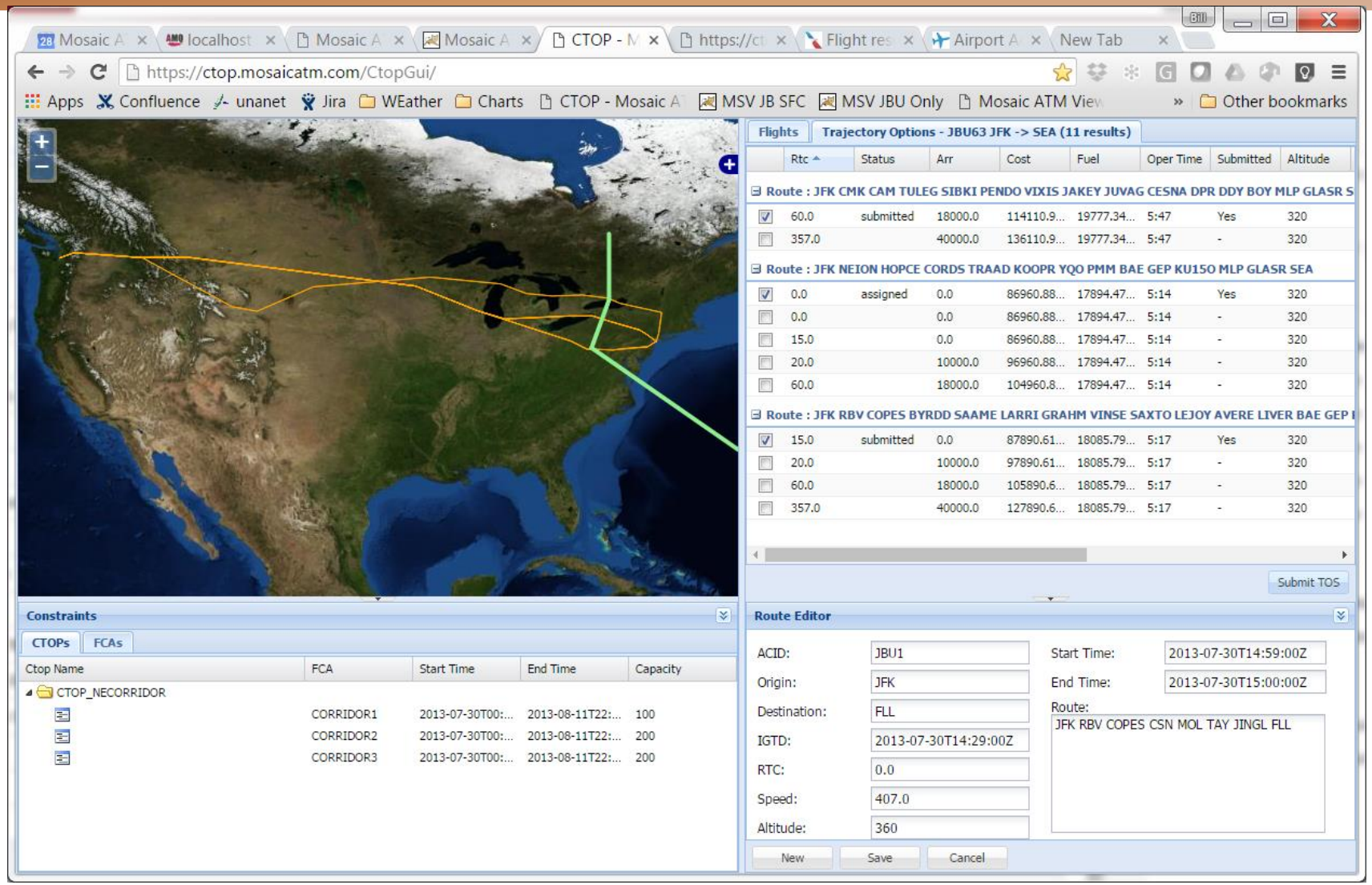

https://ctop.mosaicatm.com/CtopGui/
Flights
Trajectory Options - JBU15 JFK -> SFO (10 results)
Acid Origin Dest Igtd Edct Status Filed
JBU14 LGB JFK 2013-07-30T04:00:00Z impacted
JBU15 JFK SFO 2013-07-30T12:53:00Z impacted
JBU16 SFO JFK 2013-07-30T14:00:00Z impacted
JBU19 BOS SAN 2013-07-30T21:25:00Z impacted
JBU20 SAN BOS 2013-07-30T05:35:00Z impacted
JBU22 PBI BOS 2013-07-30T11:20:00Z impacted
JBU23 JFK LAX 2013-07-30T11:00:00Z impacted
JBU24 LAX JFK 2013-07-30T14:00:00Z impacted
JBU26 TPA JFK 2013-07-30T18:43:00Z impacted
JBU27 EWR MCO 2013-07-30T10:00:00Z impacted
JBU28 MCO EWR 2013-07-30T11:58:00Z impacted
JBU41 JFK FLL 2013-07-30T16:39:00Z impacted
JBU49 BOS MCO 2013-07-30T10:00:00Z impacted
JBU50 MCO BOS 2013-07-30T22:45:00Z impacted
JBU53 JFK PBI 2013-07-30T14:29:00Z impacted
JBU54 PBI JFK 2013-07-30T18:15:00Z impacted
Filter Editor
Acid:
Origin:
Destination:
Route:
Time Range:
TOS Status:
CTOP:
FCA: All
Filter Flights
Reset
Constraints
CTOPs
FCAs
Ctop Name FCA Start Time End Time Capacity
CTOP_NECORRIDOR
CORRIDOR1 2013-07-30T00:... 2013-08-11T22:... 100
CORRIDOR2 2013-07-30T00:... 2013-08-11T22:... 200
CORRIDOR3 2013-07-30T00:... 2013-08-11T22:... 200

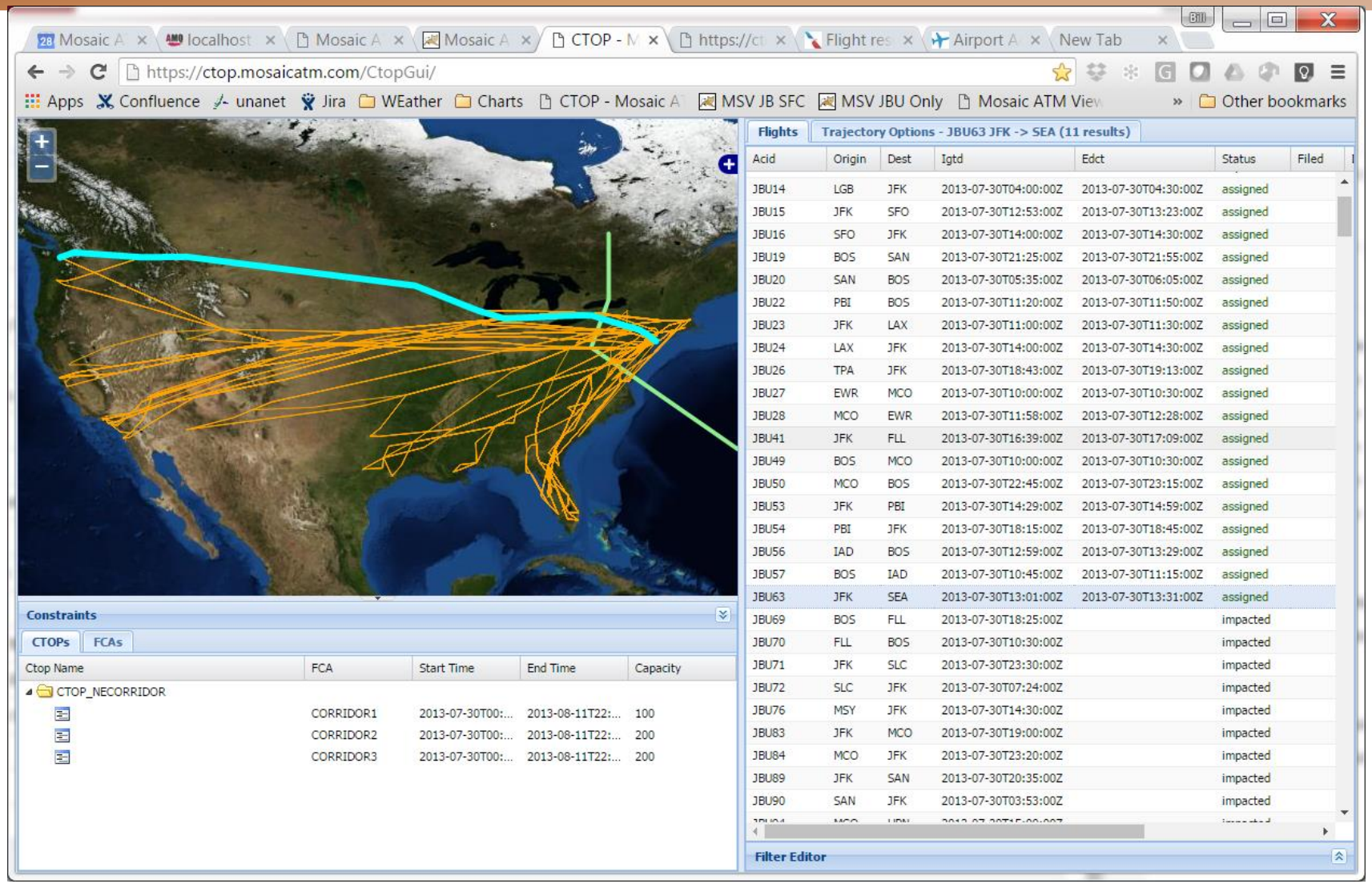

https://ctop.mosaicatm.com/CtopGui/
Flights
Trajectory Options - JBU15 JFK -> SFO (10 results)
Rtc
Status
Arr
Cost
Fuel
Oper Time
Submitted
Altitude
Route : JFK CMK CAM TULEG SIBKI PENDO VIXIS JAKEY JUVAG CESNA DPR DDY GIPEC JEKUV OILL
60.0 submitted 18000.0 117475.0... 20469.58... 5:59 Yes 320
513.0 submitted 40000.0 139475.0... 20469.58... 5:59 Yes 320
Route : JFK RBV COPES BYRDD SAAME LARRI GRAHM VINSE AIR ROD BVT HCT DBL OAL LOCKE SFO
15.0 submitted 0.0 92058.82... 18943.51... 5:32 Yes 320
20.0 submitted 10000.0 102058.8... 18943.51... 5:32 Yes 320
60.0 submitted 18000.0 110058.8... 18943.51... 5:32 Yes 320
Route : JFK RBV SARAA SUZIE RAV EWC BSV KC66Q KG66K KP69G KD66Y EKR OAL LOCKE SFO
0.0 submitted 0.0 91901.26... 18911.09... 5:32 Yes 320
0.0 0.0 91901.26... 18911.09... 5:32 - 320
15.0 submitted 0.0 91901.26... 18911.09... 5:32 Yes 320
20.0 submitted 10000.0 101901.2... 18911.09... 5:32 Yes 320
60.0 submitted 18000.0 109901.2... 18911.09... 5:32 Yes 320
Submit TOS
Constraints
CTOPs
FCAs
Ctop Name
FCA
Start Time
End Time
Capacity
CTOP_NECORRIDOR
CORRIDOR1 2013-07-30T00:... 2013-08-11T22:... 100
CORRIDOR2 2013-07-30T00:... 2013-08-11T22:... 200
CORRIDOR3 2013-07-30T00:... 2013-08-11T22:... 200
Route Editor
ACID: JBU1
Origin: JFK
Destination: FLL
IGTD: 2013-07-30T14:29:00Z
RTC: 0.0
Speed: 407.0
Altitude: 360
Start Time: 2013-07-30T14:59:00Z
End Time: 2013-07-30T15:00:00Z
Route:
JFK RBV COPES CSN MOL TAY JINGL FLL
New
Save
Cancel


https://ctop.mosaicatm.com/CtopGui/
Flights
Trajectory Options - JBU15 JFK -> SFO (10 results)
Rtc
Status
Arr
Cost
Fuel
Oper Time
Submitted
Altitude
Route : JFK CMK CAM TULEG SIBKI PENDO VIXIS JAKEY JUVAG CESNA DPR DDY GIPEC JEKUV OILL
60.0 submitted 18000.0 117475.0... 20469.58... 5:59 Yes 320
513.0 40000.0 139475.0... 20469.58... 5:59 - 320
Route : JFK RBV COPES BYRDD SAAME LARRI GRAHM VINSE AIR ROD BVT HCT DBL OAL LOCKE SFO
15.0 submitted 0.0 92058.82... 18943.51... 5:32 Yes 320
20.0 10000.0 102058.8... 18943.51... 5:32 - 320
60.0 18000.0 110058.8... 18943.51... 5:32 - 320
Route : JFK RBV SARAA SUZIE RAV EWC BSV KC66Q KG66K KP69G KD66Y EKR OAL LOCKE SFO
0.0 assigned 0.0 91901.26... 18911.09... 5:32 Yes 320
0.0 0.0 91901.26... 18911.09... 5:32 - 320
15.0 0.0 91901.26... 18911.09... 5:32 - 320
20.0 10000.0 101901.2... 18911.09... 5:32 - 320
60.0 18000.0 109901.2... 18911.09... 5:32 - 320
Submit TOS
Constraints
CTOPs
FCAs
Ctop Name
FCA
Start Time
End Time
Capacity
CTOP_NECORRIDOR
CORRIDOR1 2013-07-30T00:... 2013-08-11T22:... 100
CORRIDOR2 2013-07-30T00:... 2013-08-11T22:... 200
CORRIDOR3 2013-07-30T00:... 2013-08-11T22:... 200
Route Editor
ACID: JBU1
Origin: JFK
Destination: FLL
IGTD: 2013-07-30T14:29:00Z
RTC: 0.0
Speed: 407.0
Altitude: 360
Start Time: 2013-07-30T14:59:00Z
End Time: 2013-07-30T15:00:00Z
Route:
JFK RBV COPES CSN MOL TAY JINGL FLL
New
Save
Cancel


https://ctop.mosaicatm.com/CtopGui/
Flights
Trajectory Options - JBU14 LGB -> JFK (9 results)
Rtc
Status
Arr
Cost
Fuel
Oper Time
Submitted
Altitude
Route : LGB OCN JLI JOTNU BLD DVC KD54W KK60E KG63M KI63Q CTW AIR AHTIY OBEID GALLS C
15.0 submitted 0.0 90968.84... 18719.22... 5:28 Yes 350
20.0 10000.0 100968.8... 18719.22... 5:28 - 350
60.0 18000.0 108968.8... 18719.22... 5:28 - 350
356.0 40000.0 130968.8... 18719.22... 5:28 - 350
Route : LGB OCN JLI JOTNU BLD HBU BDF DJB ETG LVZ JFK
0.0 assigned 0.0 89763.39... 18471.16... 5:24 Yes 350
0.0 0.0 89763.39... 18471.16... 5:24 - 350
15.0 0.0 89763.39... 18471.16... 5:24 - 350
20.0 10000.0 99763.39... 18471.16... 5:24 - 350
60.0 18000.0 107763.3... 18471.16... 5:24 - 350
Submit TOS
Constraints
CTOPs
FCAs
Ctop Name
FCA
Start Time
End Time
Capacity
CTOP_NECORRIDOR
CORRIDOR1 2013-07-30T00:... 2013-08-11T22:... 100
CORRIDOR2 2013-07-30T00:... 2013-08-11T22:... 200
CORRIDOR3 2013-07-30T00:... 2013-08-11T22:... 200
Route Editor
ACID: JBU1
Origin: JFK
Destination: FLL
IGTD: 2013-07-30T14:29:00Z
RTC: 0.0
Speed: 407.0
Altitude: 360
Start Time: 2013-07-30T14:59:00Z
End Time: 2013-07-30T15:00:00Z
Route:
JFK RBV COPES CSN MOL TAY JINGL FLL
New
Save
Cancel


https://ctop.mosaicatm.com/CtopGui/
Apps
Confluence
unanet
Jira
WEather
Charts
CTOP - Mosaic A
MSV JB SFC
MSV JBU Only
Other bookmarks
Flights
Trajectory Options - JBU57 BOS -> IAD (7 results)
Acid Origin Dest Igtd Edct Status Filed
JBU14 LGB JFK 2013-07-30T04:00:00Z 2013-07-30T04:30:00Z assigned
JBU15 JFK SFO 2013-07-30T12:53:00Z 2013-07-30T13:23:00Z assigned
JBU16 SFO JFK 2013-07-30T14:00:00Z 2013-07-30T14:30:00Z assigned
JBU19 BOS SAN 2013-07-30T21:25:00Z 2013-07-30T21:55:00Z assigned
JBU20 SAN BOS 2013-07-30T05:35:00Z 2013-07-30T06:05:00Z assigned
JBU22 PBI BOS 2013-07-30T11:20:00Z 2013-07-30T11:50:00Z assigned
JBU23 JFK LAX 2013-07-30T11:00:00Z 2013-07-30T11:30:00Z assigned
JBU24 LAX JFK 2013-07-30T14:00:00Z 2013-07-30T14:30:00Z assigned
JBU26 TPA JFK 2013-07-30T18:43:00Z 2013-07-30T19:13:00Z assigned
JBU27 EWR MCO 2013-07-30T10:00:00Z 2013-07-30T10:30:00Z assigned
JBU28 MCO EWR 2013-07-30T11:58:00Z 2013-07-30T12:28:00Z assigned
JBU41 JFK FLL 2013-07-30T16:39:00Z 2013-07-30T17:09:00Z assigned
JBU49 BOS MCO 2013-07-30T10:00:00Z 2013-07-30T10:30:00Z assigned
JBU50 MCO BOS 2013-07-30T22:45:00Z 2013-07-30T23:15:00Z assigned
JBU53 JFK PBI 2013-07-30T14:29:00Z 2013-07-30T14:59:00Z assigned
JBU54 PBI JFK 2013-07-30T18:15:00Z 2013-07-30T18:45:00Z assigned
JBU56 IAD BOS 2013-07-30T12:59:00Z 2013-07-30T13:29:00Z assigned
JBU57 BOS IAD 2013-07-30T10:45:00Z impacted
JBU63 JFK SEA 2013-07-30T13:01:00Z impacted
JBU69 BOS FLL 2013-07-30T18:25:00Z impacted
JBU70 FLL BOS 2013-07-30T10:30:00Z impacted
JBU71 JFK SLC 2013-07-30T23:30:00Z impacted
JBU72 SLC JFK 2013-07-30T07:24:00Z impacted
JBU76 MSY JFK 2013-07-30T14:30:00Z impacted
JBU83 JFK MCO 2013-07-30T19:00:00Z impacted
JBU84 MCO JFK 2013-07-30T23:20:00Z impacted
JBU89 JFK SAN 2013-07-30T20:35:00Z impacted
JBU90 SAN JFK 2013-07-30T03:53:00Z impacted
Filter Editor
Constraints
CTOPs
FCAs
Ctop Name FCA Start Time End Time Capacity
CTOP_NECORRIDOR
CORRIDOR1 2013-07-30T00:... 2013-08-11T22:... 100
CORRIDOR2 2013-07-30T00:... 2013-08-11T22:... 200
CORRIDOR3 2013-07-30T00:... 2013-08-11T22:... 200


https://ctop.mosaicatm.com/CtopGui/
Apps
Confluence
unanet
Jira
WEather
Charts
CTOP - Mosaic A
MSV JB SFC
MSV JBU Only
Mosaic ATM Vie
Other bookmarks
Flights
Trajectory Options - JBU63 JFK -> SEA (11 results)
Rtc
Status
Arr
Cost
Fuel
Oper Time
Submitted
Altitude
Route : JFK CMK CAM TULEG SIBKI PENDO VIXIS JAKEY JUVAG CESNA DPR DDY BOY MLP GLASR S
60.0 submitted 18000.0 114110.9... 19777.34... 5:47 Yes 320
357.0 40000.0 136110.9... 19777.34... 5:47 - 320
Route : JFK NEION HOPCE CORDS TRAAD KOOPR YQO PMM BAE GEP KU150 MLP GLASR SEA
0.0 assigned 0.0 86960.88... 17894.47... 5:14 Yes 320
0.0 0.0 86960.88... 17894.47... 5:14 - 320
15.0 0.0 86960.88... 17894.47... 5:14 - 320
20.0 10000.0 96960.88... 17894.47... 5:14 - 320
60.0 18000.0 104960.8... 17894.47... 5:14 - 320
Route : JFK RBV COPES BYRDD SAAME LARRI GRAHM VINSE SAXTO LEJOY AVERE LIVER BAE GEP
15.0 submitted 0.0 87890.61... 18085.79... 5:17 Yes 320
20.0 10000.0 97890.61... 18085.79... 5:17 - 320
60.0 18000.0 105890.6... 18085.79... 5:17 - 320
357.0 40000.0 127890.6... 18085.79... 5:17 - 320
Submit TOS
Constraints
CTOPs
FCAs
Ctop Name
FCA
Start Time
End Time
Capacity
CTOP_NECORRIDOR
CORRIDOR1 2013-07-30T00:... 2013-08-11T22:... 100
CORRIDOR2 2013-07-30T00:... 2013-08-11T22:... 200
CORRIDOR3 2013-07-30T00:... 2013-08-11T22:... 200
Route Editor
ACID: JBU1
Origin: JFK
Destination: FLL
IGTD: 2013-07-30T14:29:00Z
RTC: 0.0
Speed: 407.0
Altitude: 360
Start Time: 2013-07-30T14:59:00Z
End Time: 2013-07-30T15:00:00Z
Route:
JFK RBV COPES CSN MOL TAY JINGL FLL
New
Save
Cancel


https://ctop.mosaicatm.com/CtopGui/
Apps
Confluence
unanet
Jira
WEather
Charts
CTOP - Mosaic A
MSV JB SFC
MSV JBU Only
Other bookmarks
Flights
Trajectory Options - JBU63 JFK -> SEA (11 results)
Acid Origin Dest Igtd Edct Status Filed
JBU14 LGB JFK 2013-07-30T04:00:00Z 2013-07-30T04:30:00Z assigned
JBU15 JFK SFO 2013-07-30T12:53:00Z 2013-07-30T13:23:00Z assigned
JBU16 SFO JFK 2013-07-30T14:00:00Z 2013-07-30T14:30:00Z assigned
JBU19 BOS SAN 2013-07-30T21:25:00Z 2013-07-30T21:55:00Z assigned
JBU20 SAN BOS 2013-07-30T05:35:00Z 2013-07-30T06:05:00Z assigned
JBU22 PBI BOS 2013-07-30T11:20:00Z 2013-07-30T11:50:00Z assigned
JBU23 JFK LAX 2013-07-30T11:00:00Z 2013-07-30T11:30:00Z assigned
JBU24 LAX JFK 2013-07-30T14:00:00Z 2013-07-30T14:30:00Z assigned
JBU26 TPA JFK 2013-07-30T18:43:00Z 2013-07-30T19:13:00Z assigned
JBU27 EWR MCO 2013-07-30T10:00:00Z 2013-07-30T10:30:00Z assigned
JBU28 MCO EWR 2013-07-30T11:58:00Z 2013-07-30T12:28:00Z assigned
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JBU57 BOS IAD 2013-07-30T10:45:00Z 2013-07-30T11:15:00Z assigned
JBU63 JFK SEA 2013-07-30T13:01:00Z 2013-07-30T13:31:00Z assigned
JBU69 BOS FLL 2013-07-30T18:25:00Z impacted
JBU70 FLL BOS 2013-07-30T10:30:00Z impacted
JBU71 JFK SLC 2013-07-30T23:30:00Z impacted
JBU72 SLC JFK 2013-07-30T07:24:00Z impacted
JBU76 MSY JFK 2013-07-30T14:30:00Z impacted
JBU83 JFK MCO 2013-07-30T19:00:00Z impacted
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FCAs
Ctop Name FCA Start Time End Time Capacity
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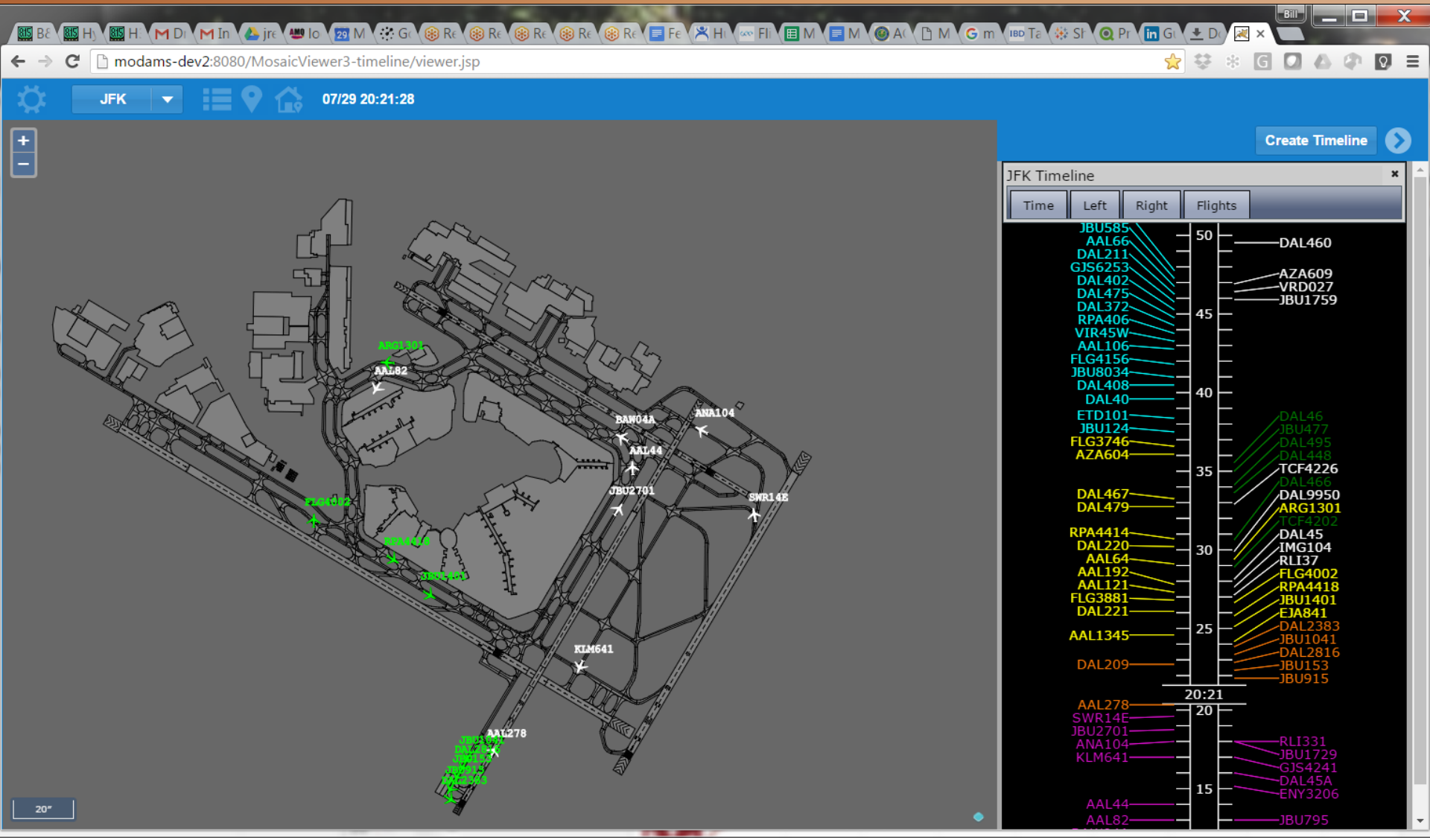
CORRIDOR2 2013-07-30T00:... 2013-08-11T22:... 200
CORRIDOR3 2013-07-30T00:... 2013-08-11T22:... 200

Current Commercial Products

- Mosaic Situation Viewer (MSV)
- Collaborative Trajectory Options Program (CTOP) Decision Aid
- Analytics Suite
- All built on common cloud-based infrastructure – SWIM Gateway

Products -> MSV

- Mosaic Situation Viewer (MSV) is a versatile central part of the product suite
  - En Route and Airport-Centric views in one display
  - Tabular flight details
  - Supports display of advanced predictive and derived data features
- Mosaic Prediction Engine (MPE) “understands” how airports, airplanes and airspace work
  - Uses all information sources (SBM) to build the current picture: where are flights, what configurations are in use, etc
  - Predicts progress of flights through the system, based on current situation and fundamental separation constraints, flow restrictions, etc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Left
Right
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ANA104
AAL44
JBU2701
SWR14E
KLM641
AAL278
JBU585
AAL66
DAL211
GJS6253
DAL402
DAL475
DAL372
RPA406
VIR45W
AAL106
FLG4156
JBU8034
DAL408
DAL40
ETD101
JBU124
FLG3746
AZA604
DAL467
DAL479
RPA4414
DAL220
AAL64
AAL192
AAL121
FLG3881
DAL221
AAL1345
DAL209
DAL460
AZA609
VRD027
JBU1759
DAL46
JBU477
DAL495
DAL448
TCF4226
DAL466
DAL9950
ARG1301
TCF4202
DAL45
IMG104
RLI37
FLG4002
RPA4418
JBU1401
EJA841
DAL2383
JBU1041
DAL2816
JBU153
JBU915
20:21
AAL278
SWR14E
JBU2701
ANA104
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RLI331
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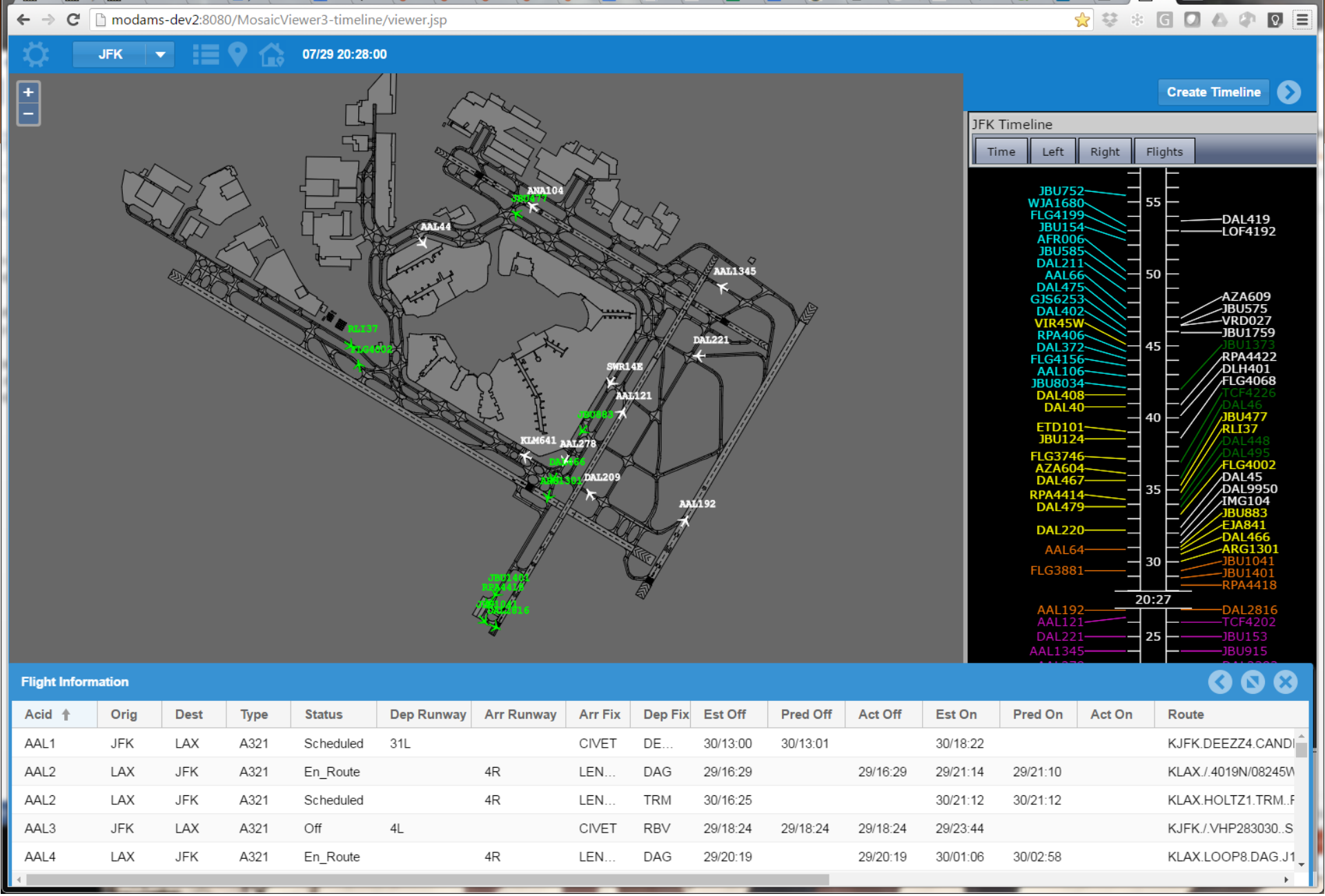

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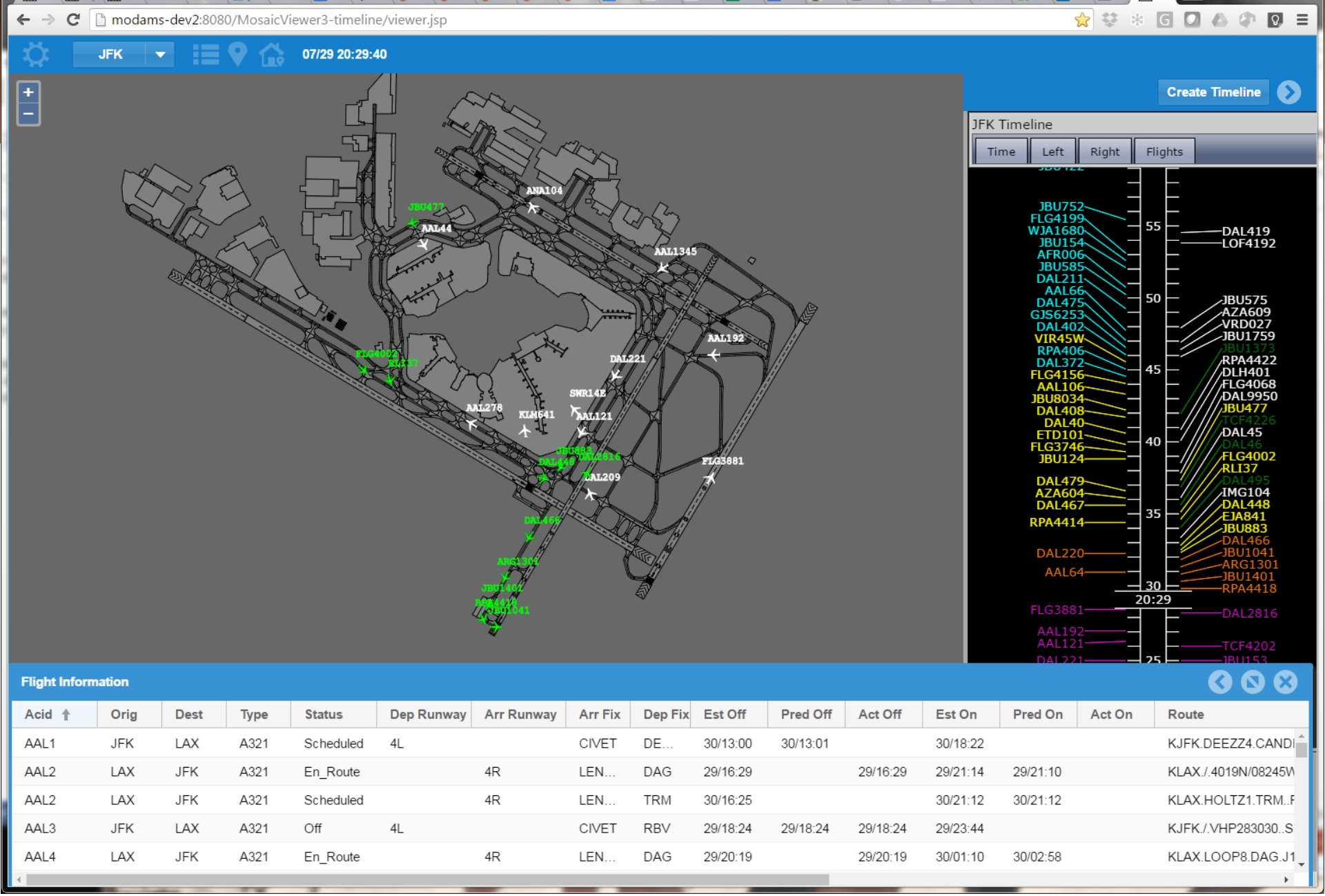
AAL1	JFK	LAX	A321	Scheduled	31L		CIVET	DE...	30/13:00	30/13:01		30/18:22			KJFK.DEEZZ4.CANDI
AAL2	LAX	JFK	A321	En_Route		4R	LEN...	DAG	29/16:29		29/16:29	29/21:14	29/21:10		KLAX./.4019N/08245W
AAL2	LAX	JFK	A321	Scheduled		4R	LEN...	TRM	30/16:25			30/21:12	30/21:12		KLAX.HOLTZ1.TRM..F
AAL3	JFK	LAX	A321	Off	4L		CIVET	RBV	29/18:24	29/18:24	29/18:24	29/23:44			KJFK./.VHP283030..S
AAL4	LAX	JFK	A321	En_Route		4R	LEN...	DAG	29/20:19		29/20:19	30/01:06	30/02:58		KLAX.LOOP8.DAG.J1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Time
Left
Right
Flights
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SWR14E
AAL278
KLM641
AAL121
FLG3881
DAL209
JBU752
FLG4199
WJA1680
JBU154
AFR006
JBU585
DAL211
AAL66
DAL475
GJS6253
DAL402
VIR45W
RPA406
DAL372
FLG4156
AAL106
JBU8034
DAL408
DAL40
ETD101
FLG3746
JBU124
DAL479
AZA604
DAL467
RPA4414
DAL220
AAL64
FLG3881
AAL192
AAL121
DAL419
LOF4192
JBU575
AZA609
VRD027
JBU1759
RPA4422
DLH401
FLG4068
DAL9950
JBU477
DAL45
FLG4002
RLI37
IMG104
DAL448
EJA841
JBU883
DAL466
JBU1041
ARG1301
JBU1401
RPA4418
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DAL2816
TCF4202
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40
35
30
25
Flight Information
Acid
Orig
Dest
Type
Status
Dep Runway
Arr Runway
Arr Fix
Dep Fix
Est Off
Pred Off
Act Off
Est On
Pred On
Act On
Route
AAL1 JFK LAX A321 Scheduled 4L CIVET DE... 30/13:00 30/13:01 30/18:22 KJFK.DEEZZ4.CANDI
AAL2 LAX JFK A321 En_Route 4R LEN... DAG 29/16:29 29/16:29 29/21:14 29/21:10 KLAX./.4019N/08245W
AAL2 LAX JFK A321 Scheduled 4R LEN... TRM 30/16:25 30/21:12 30/21:12 KLAX.HOLTZ1.TRM..F
AAL3 JFK LAX A321 Off 4L CIVET RBV 29/18:24 29/18:24 29/18:24 29/23:44 KJFK./.VHP283030..S
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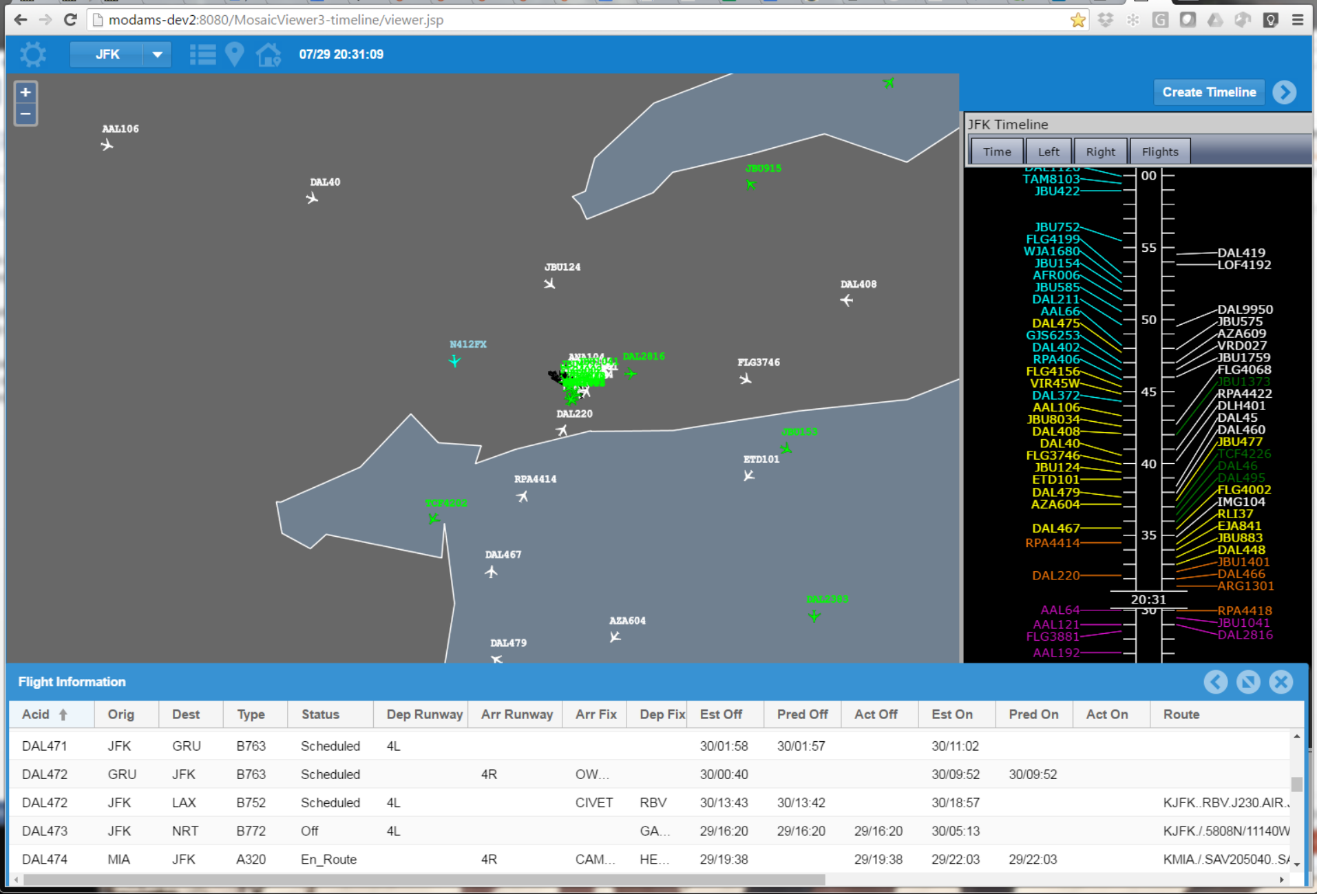

Acid	Orig	Dest	Type	Status	Dep Runway	Arr Runway	Arr Fix	Dep Fix	Est Off	Pred Off	Act Off	Est On	Pred On	Act On	Route
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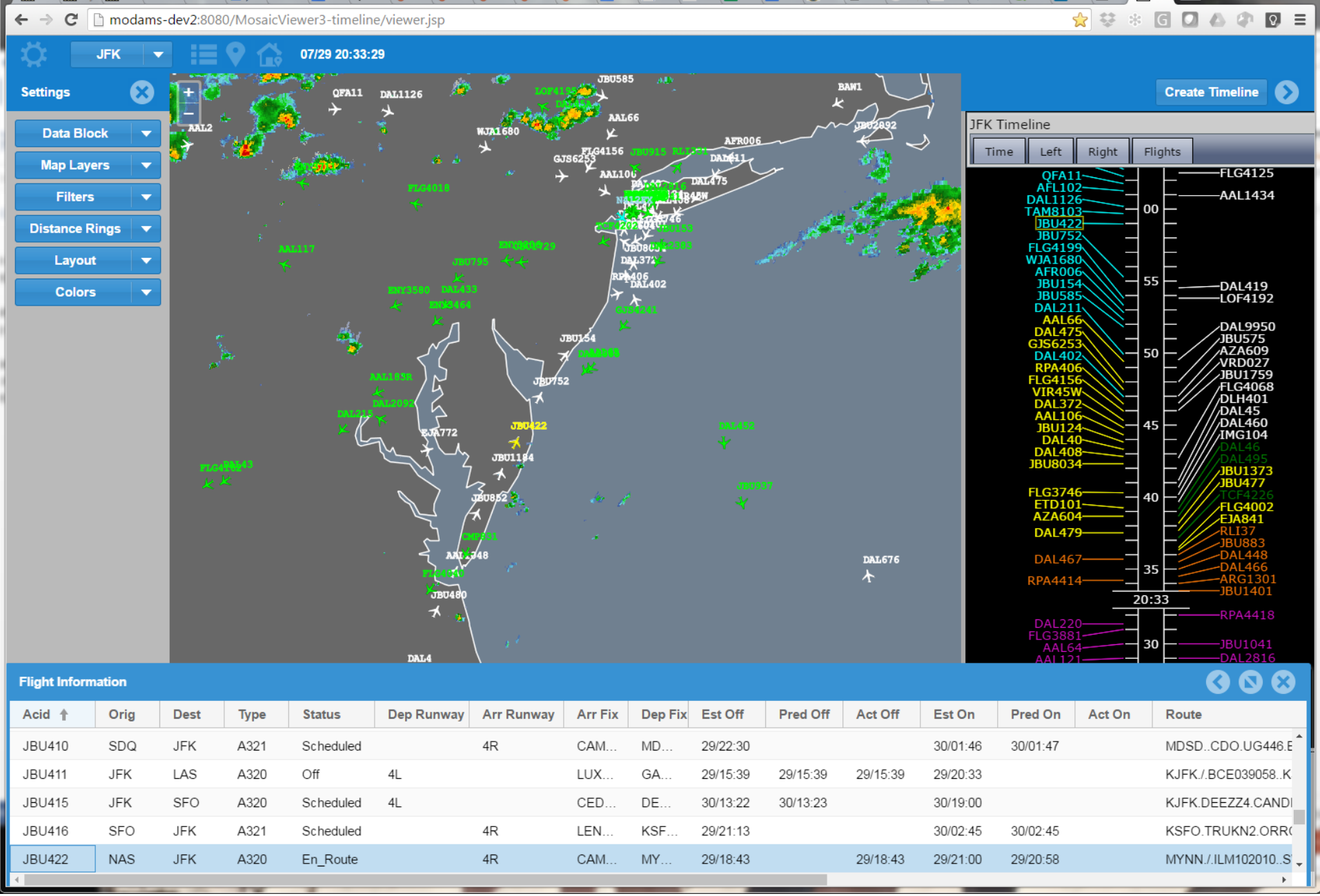
DAL472	GRU	JFK	B763	Scheduled		4R	OW…		30/00:40			30/09:52	30/09:52		
DAL472	JFK	LAX	B752	Scheduled	4L		CIVET	RBV	30/13:43	30/13:42		30/18:57			KJFK..RBV.J230.AIR..
DAL473	JFK	NRT	B772	Off	4L			GA…	29/16:20	29/16:20	29/16:20	30/05:13			KJFK./.5808N/11140W
DAL474	MIA	JFK	A320	En_Route		4R	CAM…	HE…	29/19:38		29/19:38	29/22:03	29/22:03		KMIA./.SAV205040..SA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Filters
Distance Rings
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Left
Right
Flights
20:33
Flight Information
Acid
Orig
Dest
Type
Status
Dep Runway
Arr Runway
Arr Fix
Dep Fix
Est Off
Pred Off
Act Off
Est On
Pred On
Act On
Route
JBU410 SDQ JFK A321 Scheduled 4R CAM... MD... 29/22:30 30/01:46 30/01:47 MDSD..CDO.UG446.E
JBU411 JFK LAS A320 Off 4L LUX... GA... 29/15:39 29/15:39 29/15:39 29/20:33 KJFK./.BCE039058..K
JBU415 JFK SFO A320 Scheduled 4L CED... DE... 30/13:22 30/13:23 30/19:00 KJFK.DEEZZ4.CANDI
JBU416 SFO JFK A321 Scheduled 4R LEN... KSF... 29/21:13 30/02:45 30/02:45 KSFO.TRUKN2.ORR(
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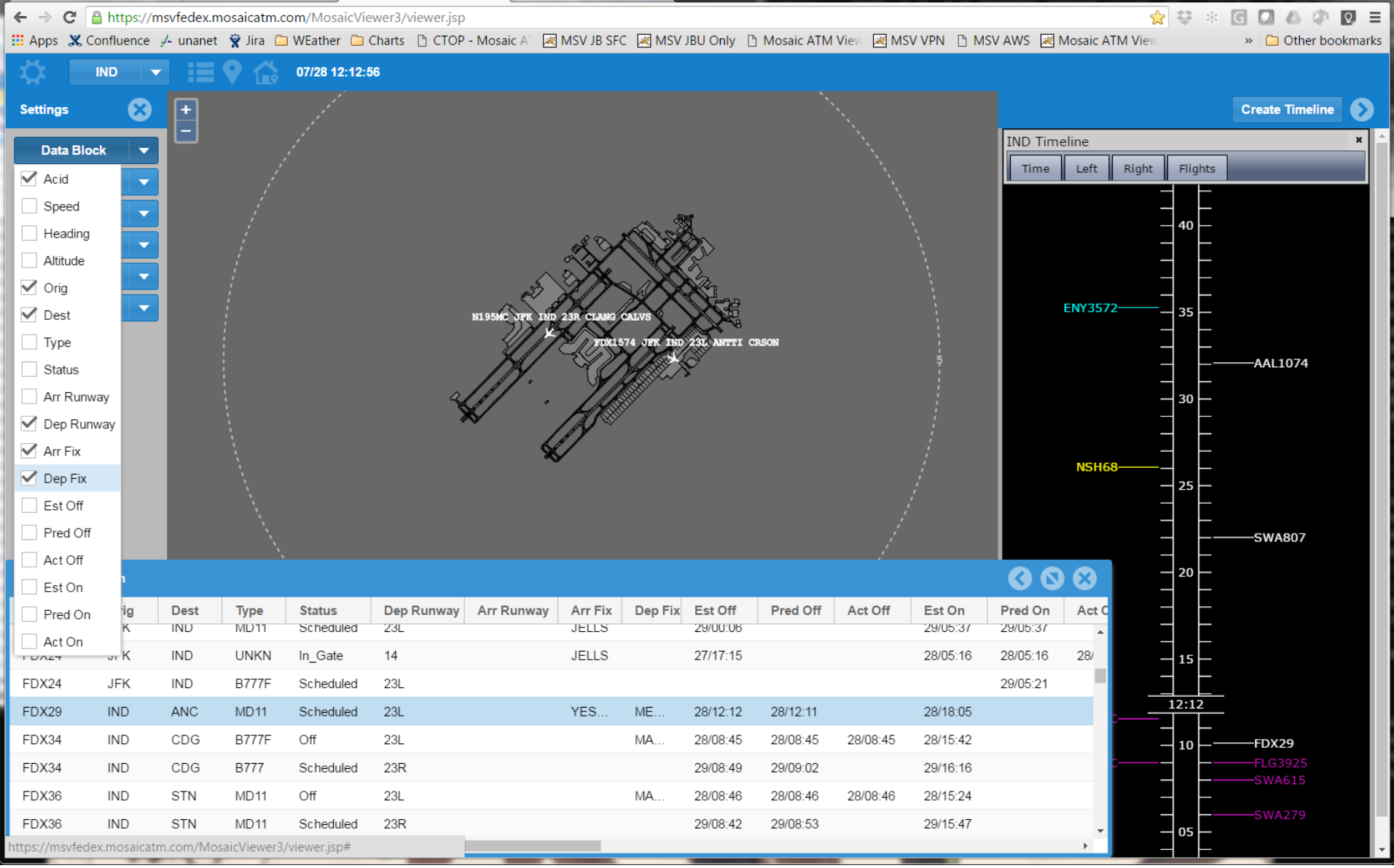
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Confluence
unanet
Jira
WEather
Charts
CTOP - Mosaic AT
MSV JB SFC
MSV JBU Only
Mosaic ATM View
MSV VPN
MSV AWS
Mosaic ATM View
Other bookmarks
IND
07/28 12:12:56
Settings
Create Timeline
Data Block
Acid
Speed
Heading
Altitude
Orig
Dest
Type
Status
Arr Runway
Dep Runway
Arr Fix
Dep Fix
Est Off
Pred Off
Act Off
Est On
Pred On
Act On
N195MC JFK IND 23R CLANG CALVS
FDX1574 JFK IND 23L ANTTI CRSON
IND Timeline
Time
Left
Right
Flights
ENY3572
NSH68
AAL1074
SWA807
FDX29
FLG3925
SWA615
SWA279
12:12
40
35
30
25
20
15
10
05
Dest
Type
Status
Dep Runway
Arr Runway
Arr Fix
Dep Fix
Est Off
Pred Off
Act Off
Est On
Pred On
IND UNKN In_Gate 14 JELLS 27/17:15 28/05:16 28/05:16
FDX24 JFK IND B777F Scheduled 23L 29/05:21
FDX29 IND ANC MD11 Scheduled 23L YES... ME... 28/12:12 28/12:11 28/18:05
FDX34 IND CDG B777F Off 23L MA... 28/08:45 28/08:45 28/08:45 28/15:42
FDX34 IND CDG B777 Scheduled 23R 29/08:49 29/09:02 29/16:16
FDX36 IND STN MD11 Off 23L MA... 28/08:46 28/08:46 28/08:46 28/15:24
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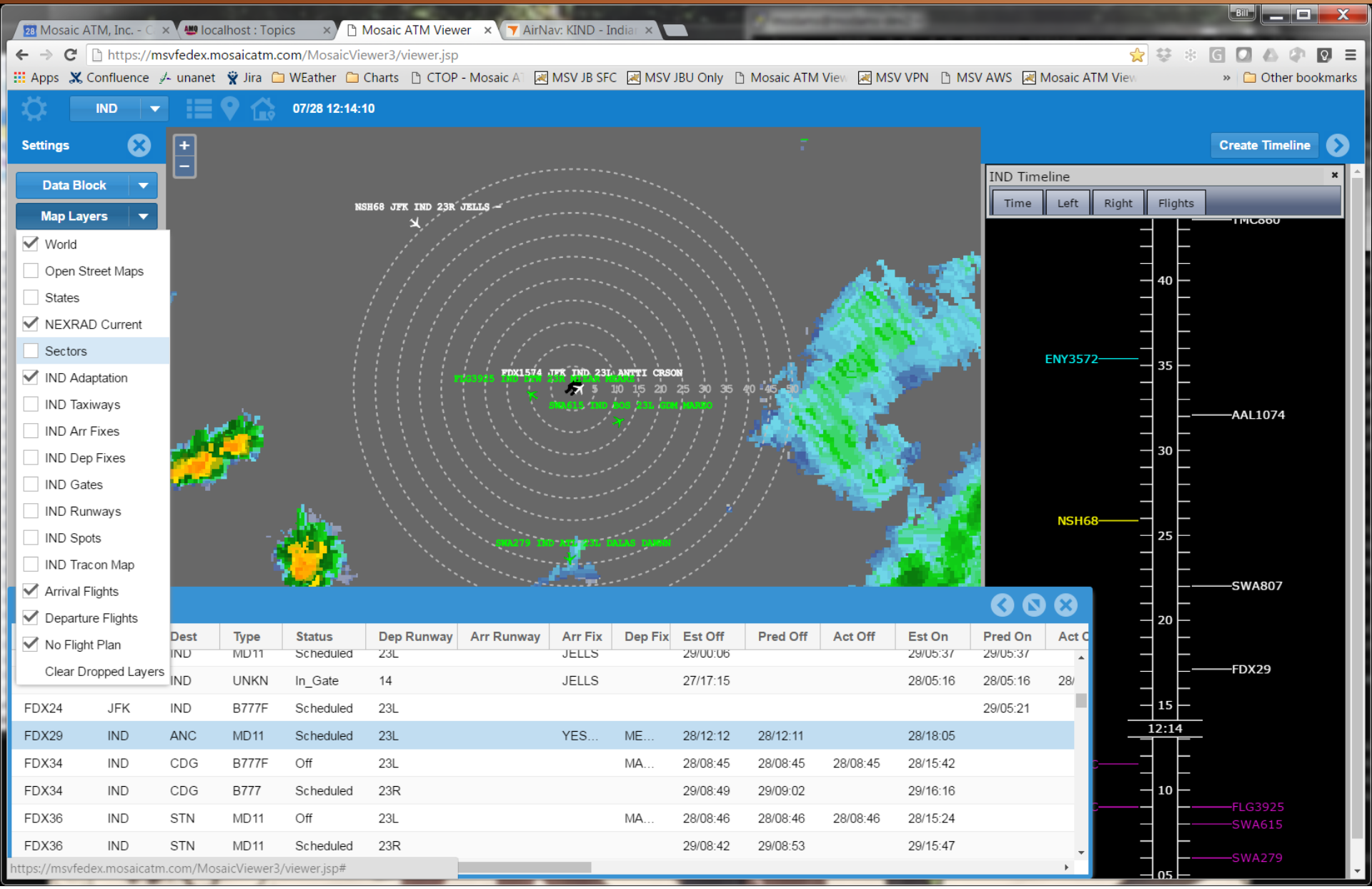
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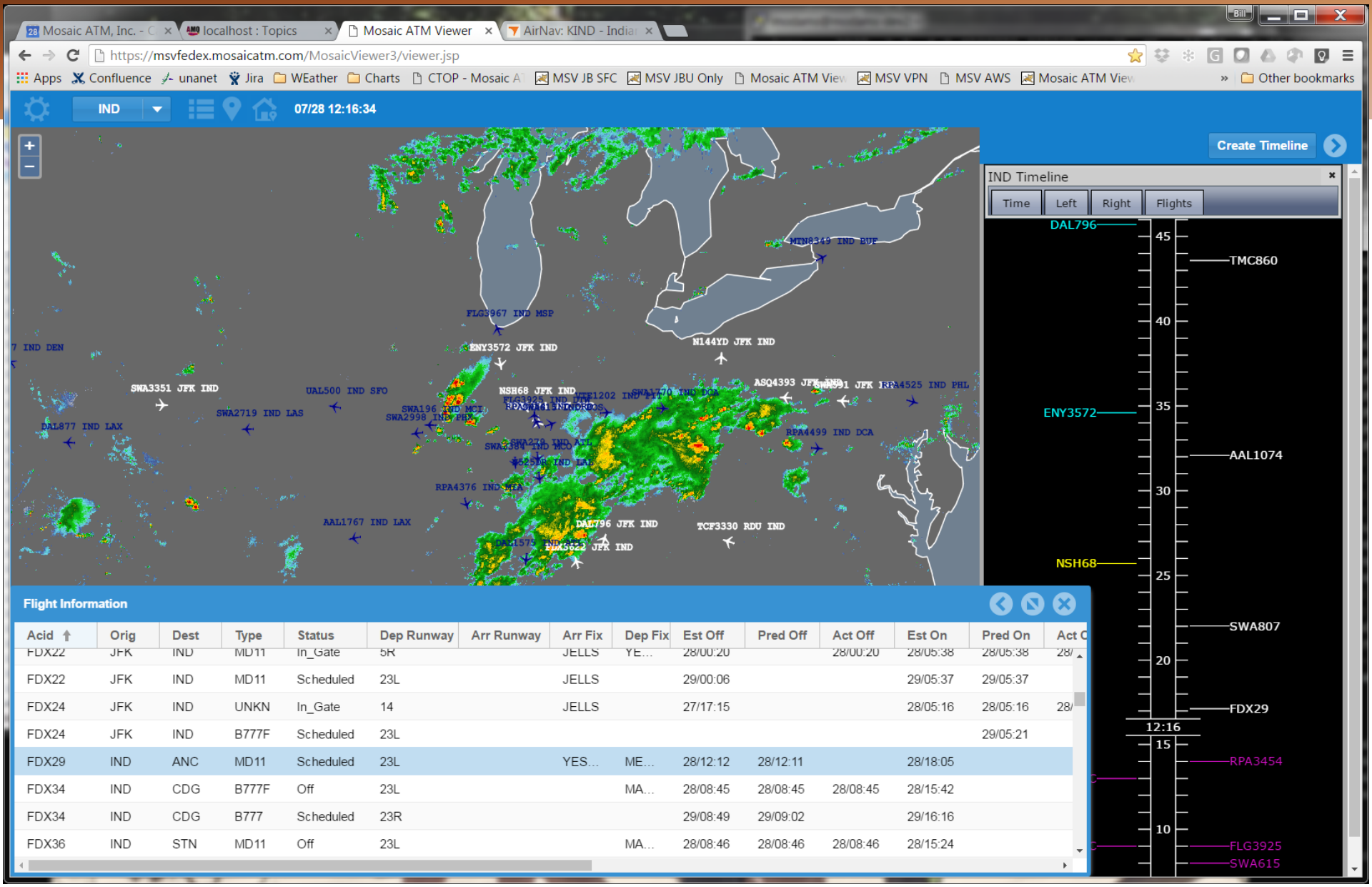
Settings
Create Timeline
Data Block
Map Layers
World
Open Street Maps
States
NEXRAD Current
Sectors
IND Adaptation
IND Taxiways
IND Arr Fixes
IND Dep Fixes
IND Gates
IND Runways
IND Spots
IND Tracon Map
Arrival Flights
Departure Flights
No Flight Plan
Clear Dropped Layers
NSH68 JFK IND 23R JELLS
FDX1574 JFK IND 23L ANTTI CRSON
IND Timeline
Time
Left
Right
Flights
ENY3572
AAL1074
NSH68
SWA807
FDX29
12:14
FLG3925
SWA615
SWA279
Dest Type Status Dep Runway Arr Runway Arr Fix Dep Fix Est Off Pred Off Act Off Est On Pred On
IND UNKN In_Gate 14 JELLS 27/17:15 28/05:16 28/05:16
FDX24 JFK IND B777F Scheduled 23L 29/05:21
FDX29 IND ANC MD11 Scheduled 23L YES... ME... 28/12:12 28/12:11 28/18:05
FDX34 IND CDG B777F Off 23L MA... 28/08:45 28/08:45 28/08:45 28/15:42
FDX34 IND CDG B777 Scheduled 23R 29/08:49 29/09:02 29/16:16
FDX36 IND STN MD11 Off 23L MA... 28/08:46 28/08:46 28/08:46 28/15:24
FDX36 IND STN MD11 Scheduled 23R 29/08:42 29/08:53 29/15:47


Mosaic ATM Viewer
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IND
07/28 12:16:34
Create Timeline
IND Timeline
Time
Left
Right
Flights
DAL796
TMC860
ENY3572
AAL1074
NSH68
SWA807
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12:16
RPA3454
FLG3925
SWA615
Flight Information
Acid
Orig
Dest
Type
Status
Dep Runway
Arr Runway
Arr Fix
Dep Fix
Est Off
Pred Off
Act Off
Est On
Pred On
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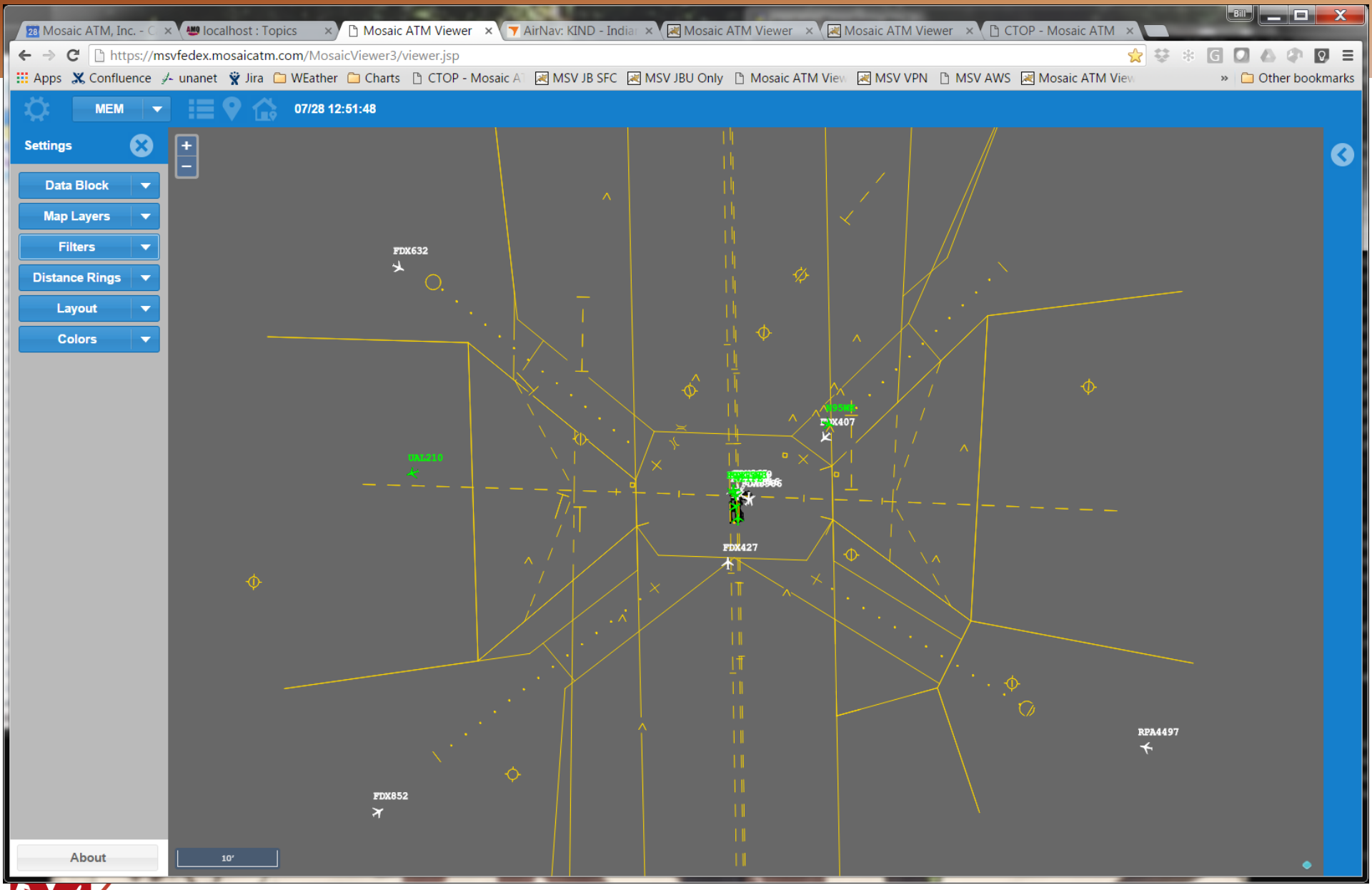
FDX22 JFK IND MD11 Scheduled 23L JELLS 29/00:06 29/05:37 29/05:37
FDX24 JFK IND UNKN In_Gate 14 JELLS 27/17:15 28/05:16 28/05:16
FDX24 JFK IND B777F Scheduled 23L 29/05:21
FDX29 IND ANC MD11 Scheduled 23L YES... ME... 28/12:12 28/12:11 28/18:05
FDX34 IND CDG B777F Off 23L MA... 28/08:45 28/08:45 28/08:45 28/15:42
FDX34 IND CDG B777 Scheduled 23R 29/08:49 29/09:02 29/16:16
FDX36 IND STN MD11 Off 23L MA... 28/08:46 28/08:46 28/08:46 28/15:24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Mosaic ATM Viewer
AirNav: KIND - Indian
Mosaic ATM Viewer
Mosaic ATM Viewer
CTOP - Mosaic ATM
https://msvfedex.mosaicatm.com/MosaicViewer3/viewer.jsp
Apps
Confluence
unanet
Jira
WEather
Charts
CTOP - Mosaic A
MSV JB SFC
MSV JBU Only
Mosaic ATM View
MSV VPN
MSV AWS
Mosaic ATM View
Other bookmarks
MEM
07/28 12:51:48
Settings
Data Block
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Layout
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About
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FDX407
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RPA4497
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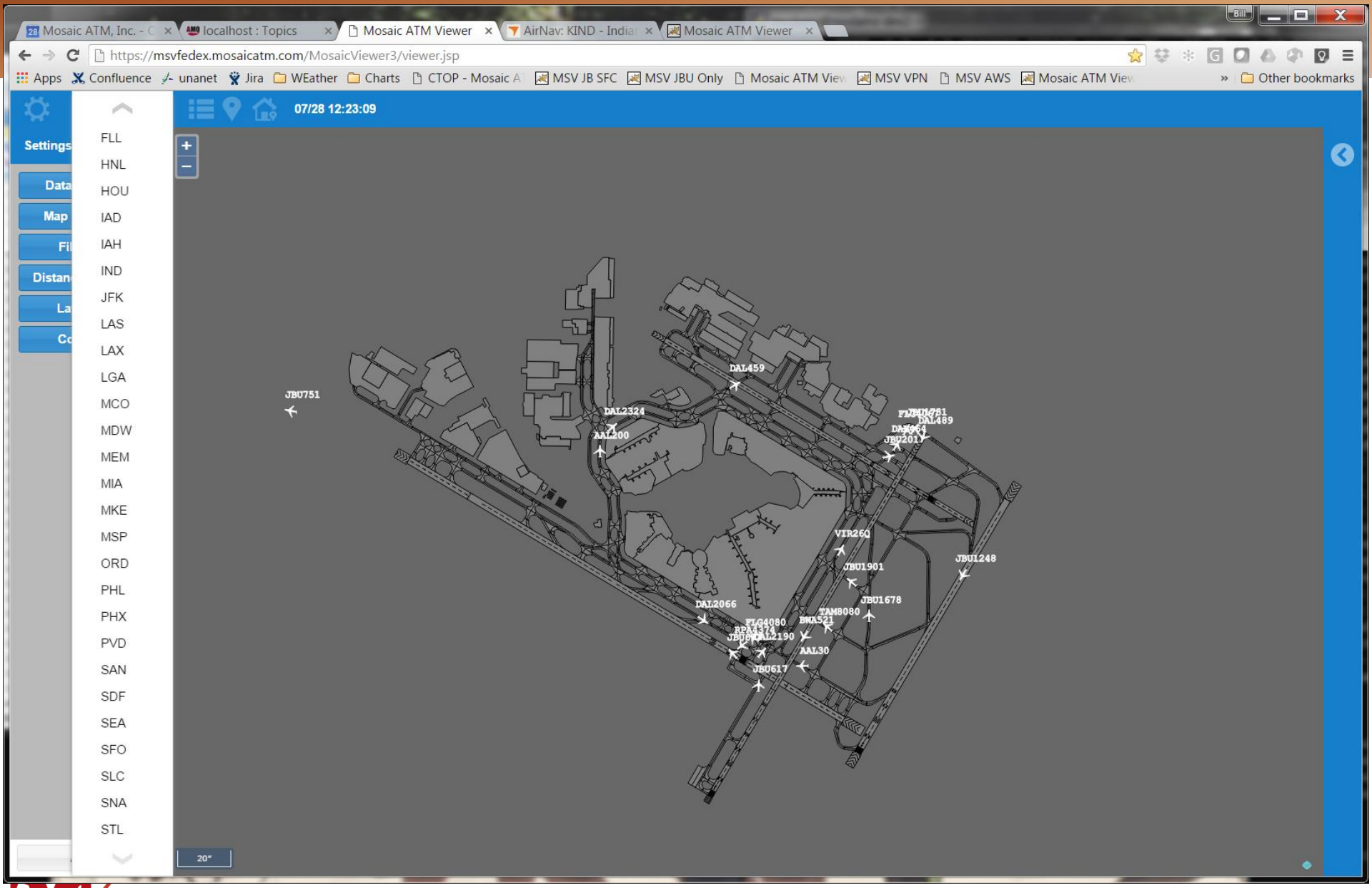
10'


Mosaic ATM, Inc.
localhost : Topics
Mosaic ATM Viewer
AirNav: KIND - Indian
Mosaic ATM Viewer
https://msvfedex.mosaicatm.com/MosaicViewer3/viewer.jsp
Apps
Confluence
unanet
Jira
WEather
Charts
CTOP - Mosaic A
MSV JB SFC
MSV JBU Only
Mosaic ATM View
MSV VPN
MSV AWS
Mosaic ATM View
Other bookmarks
Settings
Data
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La
Co
07/28 12:23:09
FLL
HNL
HOU
IAD
IAH
IND
JFK
LAS
LAX
LGA
MCO
MDW
MEM
MIA
MKE
MSP
ORD
PHL
PHX
PVD
SAN
SDF
SEA
SFO
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VIR260
JBU1901
JBU1248
DAL2066
JBU1678
TAM8080
FLG4080
BWA521
DAL2190
AAL30
JBU617

What Use?

- Looking at pictures is nice
- Knowing when things will happen so your organization can take early action is nicer
  - Data can be integrated into airline's existing tools
  - Or, presented through MSV
- Let your customers know earlier?

Flight status

« Back to search

New York to Richmond

Thursday, July 28, 2016

Flight	Depart
3993 American Airlines Operated by Air Wisconsin as American Eagle	Actual 8:38 AM LGA
Delayed: Awaiting takeoff	Scheduled: 7:59 AM Terminal: C Gate: C36

Help

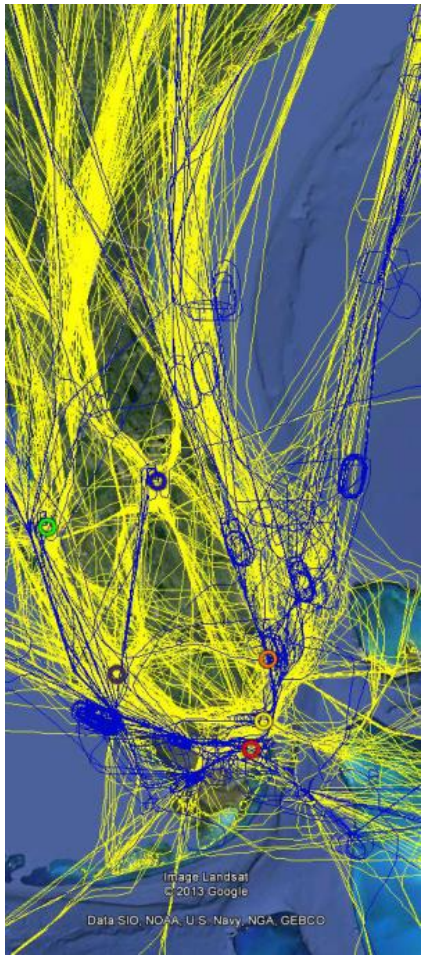
- Contact American
- Receipts and refunds
- FAQs
- Agency reference
- Cargo
- Baggage and optional service fees
- Customer service and contingency plans

About American

- About us
- Careers
- Investor relations
- Newsroom
- Legal, privacy, copyright
- Browser compatibility
- Web accessibility

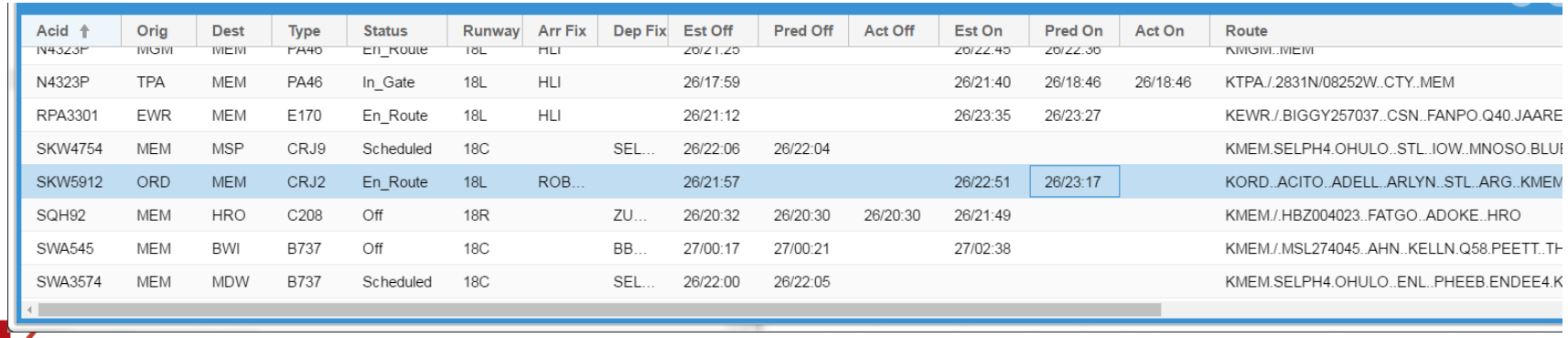
Diversion Management

- Two Diversion Management Components
  - Alerting of holding by arrival airport
  - Alerting of significant changes in ETA / Predicted Arrival Time that could lead to diversion
- Holding detection algorithm identifies tracks that enter hold
  - On recognition, sends alert
  - Early warning of impending capacity changes, e.g. for snow removal



Diversion Management

- Alerting of approach of Predicted Arrival Time to “Bingo” that could lead to diversion
  - Once capacity and demand are known, predictions incorporate congestion
  - Most accurate if operator provides bingo time directly



Acid	Orig	Dest	Type	Status	Runway	Arr Fix	Dep Fix	Est Off	Pred Off	Act Off	Est On	Pred On	Act On	Route
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N4323P	TPA	MEM	PA46	In_Gate	18L	HLI		26/17:59			26/21:40	26/18:46	26/18:46	KTPA./.2831N/08252W..CTY..MEM
RPA3301	EWR	MEM	E170	En_Route	18L	HLI		26/21:12			26/23:35	26/23:27		KEWR./.BIGGY257037..CSN..FANPO.Q40.JAARE
SKW4754	MEM	MSP	CRJ9	Scheduled	18C		SEL...	26/22:06	26/22:04					KMEM.SELPH4.OHULO..STL..IOW..MNOSO.BLUE
SKW5912	ORD	MEM	CRJ2	En_Route	18L	ROB...		26/21:57			26/22:51	26/23:17		KORD..ACITO..ADELL..ARLYN..STL..ARG..KMEM
SQH92	MEM	HRO	C208	Off	18R		ZU...	26/20:32	26/20:30	26/20:30	26/21:49			KMEM./.HBZ004023..FATGO..ADOKE..HRO
SWA545	MEM	BWI	B737	Off	18C		BB...	27/00:17	27/00:21		27/02:38			KMEM./.MSL274045..AHN..KELLN.Q58.PEETT..TH
SWA3574	MEM	MDW	B737	Scheduled	18C		SEL...	26/22:00	26/22:05					KMEM.SELPH4.OHULO..ENL..PHEEB.ENDEE4.K

Tarmac Delay Monitoring

- Tarmac Delay Monitoring computes time since boarding / door closed event through predicted off time OR on time through predicted in event
  - At non-MPE airports, only actual elapsed time shown
- Numerous paths to connect to event of choice
- Result shows as column in flights table within MSV and selectable in data tag
- Alerts can be driven and configured from calculated data element

Questions

- Show of hands:
  - Whose tools would benefit from predictions?
  - Who is interested in participating / guiding our research?

QUESTIONS?