ZLA LOS ANGELES ARTCC

Welcome to CalFLOW

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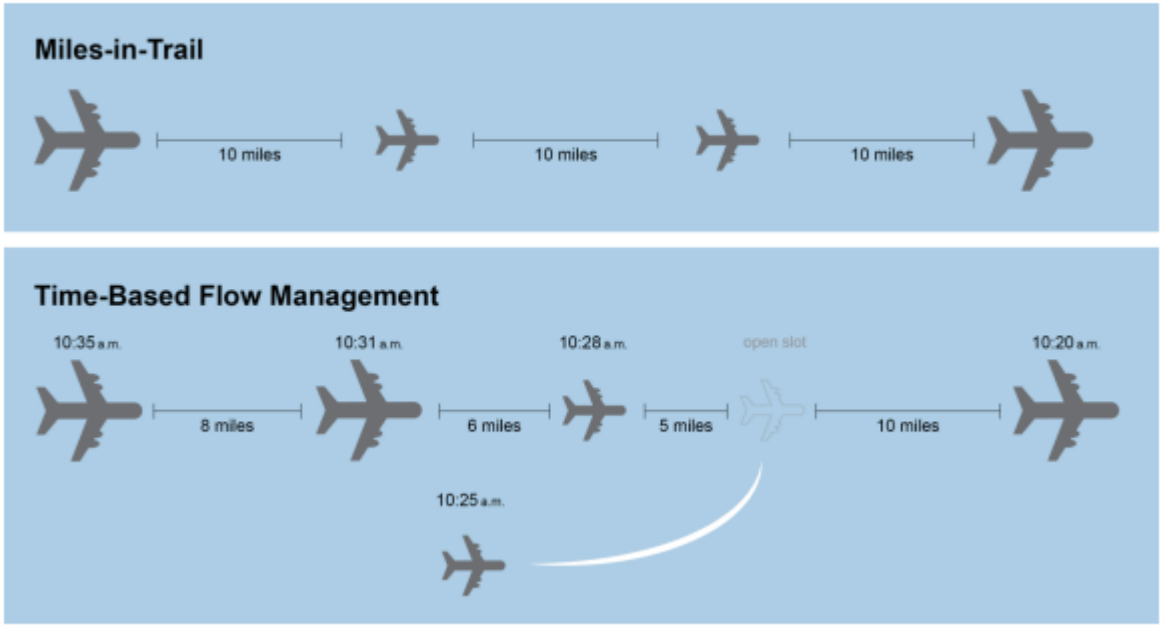
TBFM Overview

- Time-Based Flow Management
  - Assigning takeoff times to departures – in order to ensure enroute spacing to a destination
  - Essentially a departure scheduler – making an appointment for a given flight's takeoff time
  - If there are many flights to a destination, there may only be a small window to release a flight, this is where the term 'slot time' comes from
  - Different terms may be used for 'takeoff time', you may hear:
    - release time, center release, slot time, flow time, wheels-up time, EDCT

TBFM Overview

- Visual Representation of this topic – this is the goal
- Aircraft on the ground will be metered out to ensure not only de-confliction enroute, but an organized and properly spaced stream of traffic to a destination

Figure 1. Difference Between Miles-in-Trail and Time-Based Flow Management for Separating Aircraft at High Altitudes



Source: OIG analysis.

TBFM Overview

The intended downstream effect is for smooth flow into the destination TRACON without having to vector or hold any aircraft, let alone the need for ground stops

Figure 4. Differences in Aircraft Arrivals With and Without TBFM

TBFM NOT USED

- No automation tools to help controllers sequence and space aircraft
- Inconsistent flow of aircraft to airport
- Controllers more likely to direct aircraft off procedures and into holding to maintain safe spacing
- Results in more level offs (Step-down type descent)

TIME-BASED SEQUENCING (TBFM)

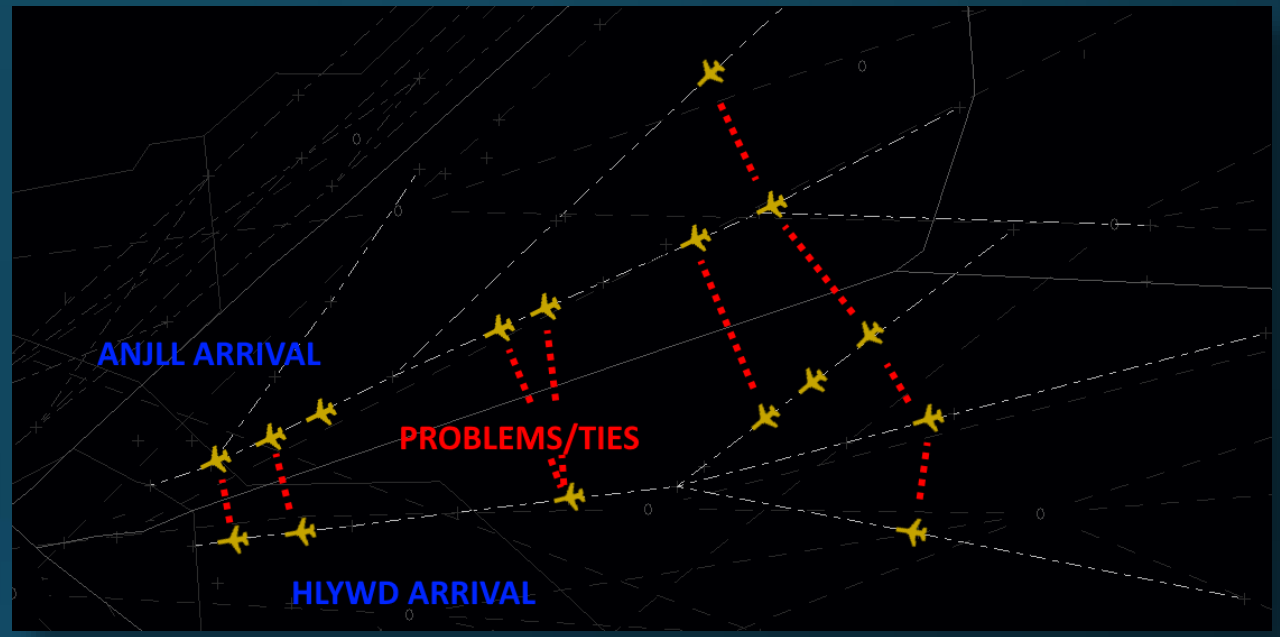
- TBFM for high altitude, but no automation for area closest to airport
- More consistent flow of traffic
- Able to use RNAVs with OPDs (optimized profile descent) instead of level offs more often
- RNPs very difficult for air traffic controllers to manage

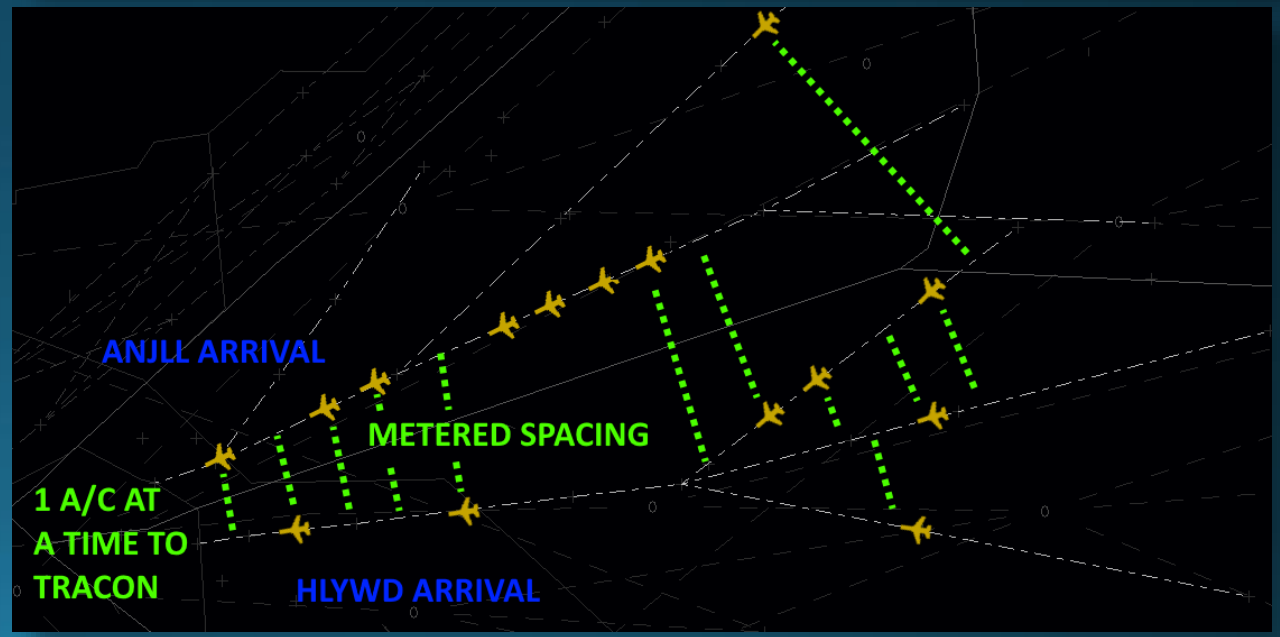
Source: OIG analysis.

TBFM Overview

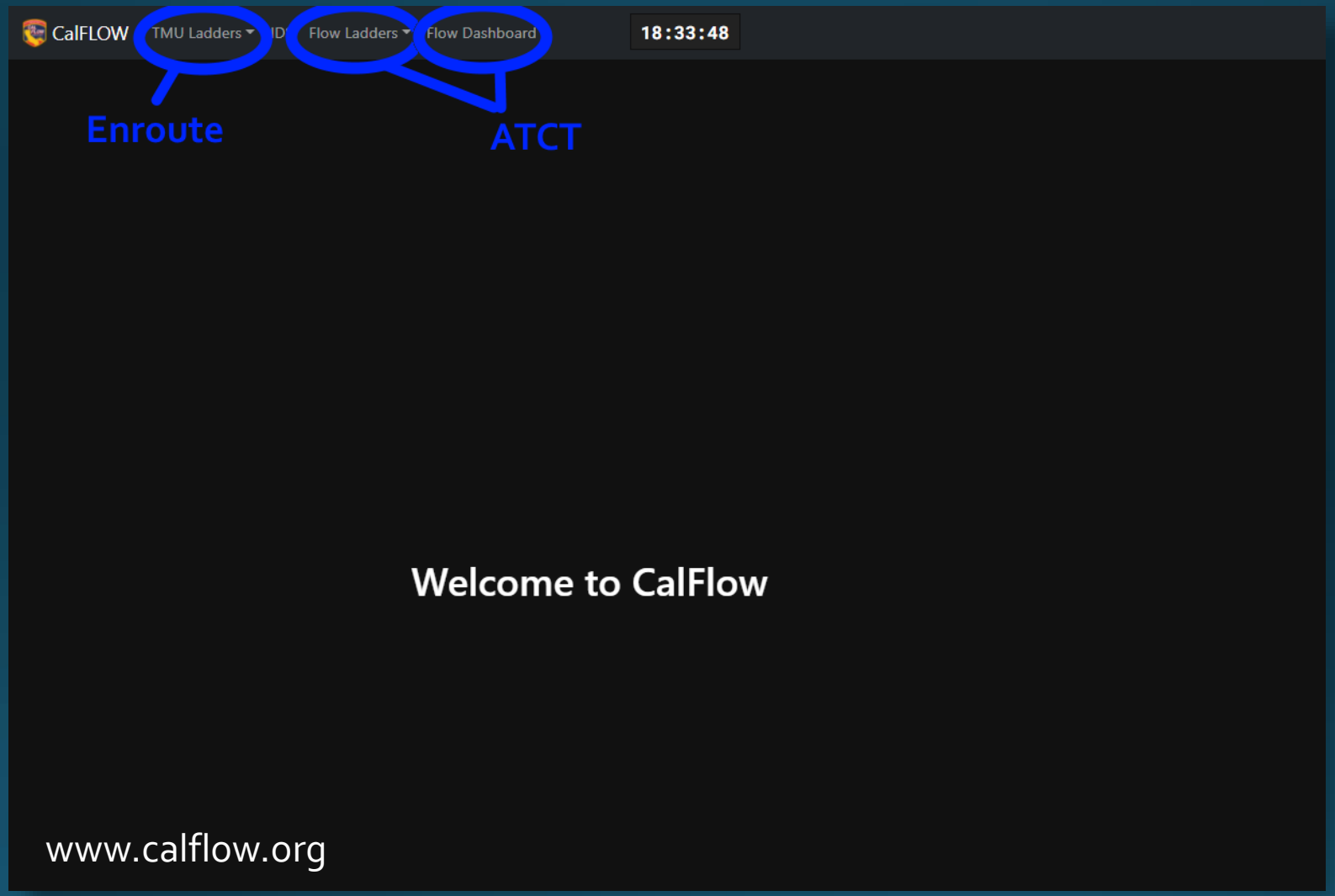
Example of enroute spacing without and with the use of TBFM

It begins with Ground and Local Controllers to make this happen





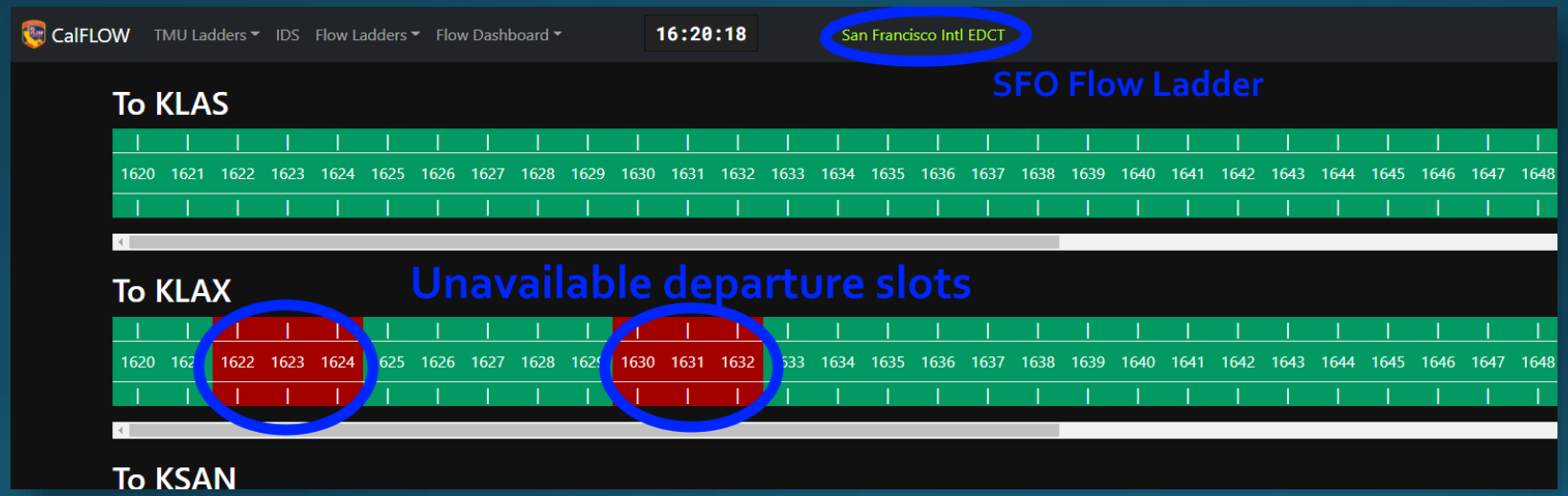
CalFLOW Intro - Website



CalFLOW Basics

Let's first take a look at the Flow Ladders

- This is SFO's set of Flow Ladders
  - A visual representation of allowed and disallowed departure slot times to specific airports, as represented by green bars with red disallowed slots
  - The far left of the bars is the current UTC time. You can see in the future to the right, and when an aircraft with a specific destination is NOT to be departed
  - This is great for getting a quick glance at what departure delays may exist
  - Keep in mind, a departure on the ground *with an assigned time* will create a red slot



CalFLOW for ATCT

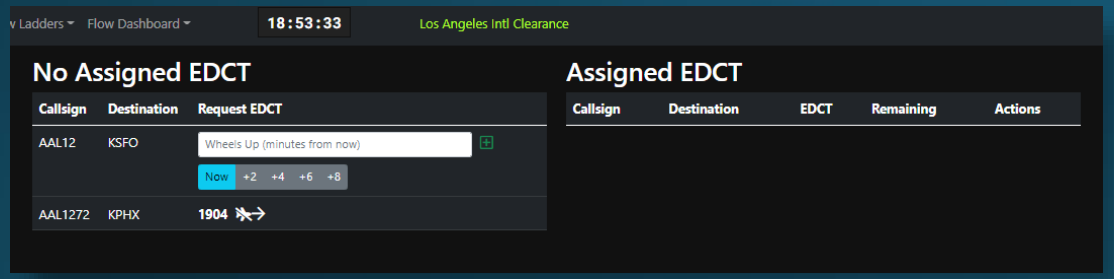
Overview

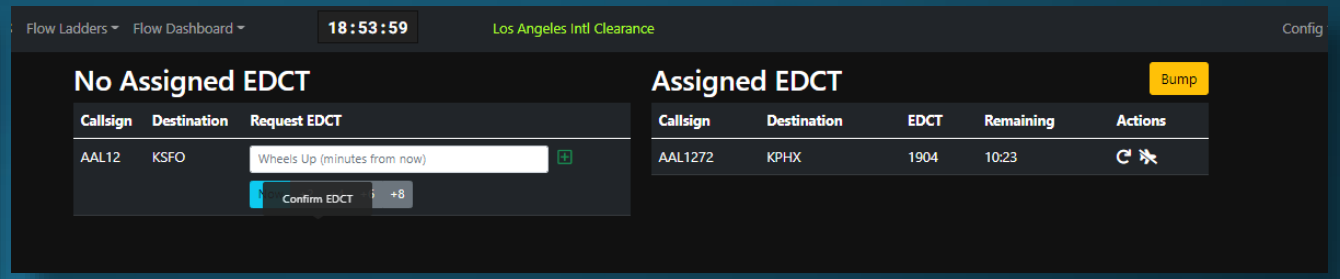
- CalFLOW is used most importantly by ATCT controllers, namely Data, Ground and Local positions
- It is Ground/Flight Data's responsibility to ensure affected aircraft are assigned flow times that they are *actually able to make*.
  - This can be a challenge when getting used to the system – will be discussed in 'best practices'
- It is Local Control's responsibility to ensure affected aircraft are airborne at their assigned-wheels up time, or if delayed, ensure CalFLOW is updated
- IRL, the wheels up time should be met +/-2 minutes at most facilities

CalFLOW for ATCT

Flow Dashboard

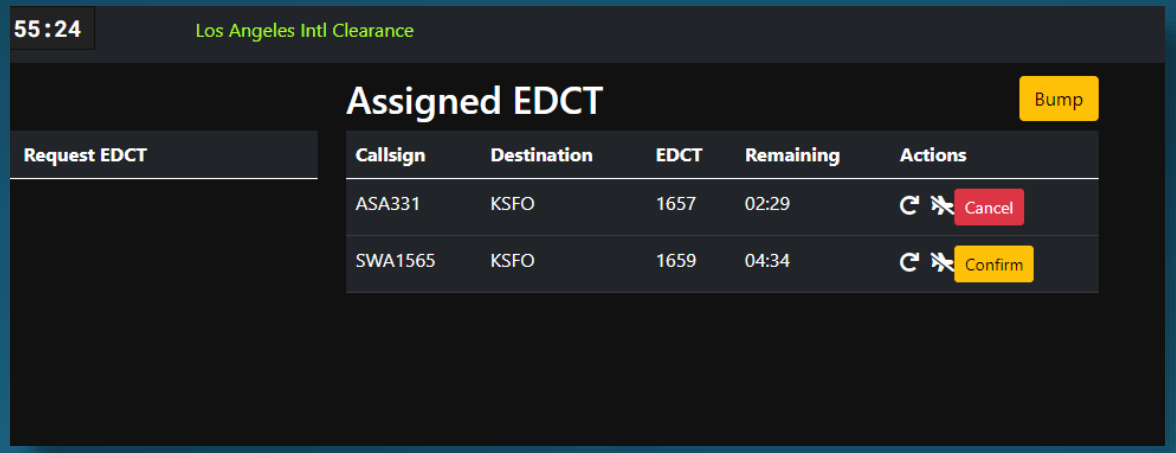
- The Flow Dashboard is where we really get into it. It's where times are assigned to departures. The page is smart and tracks routes and available release times
- To assign a wheels up time, estimate and click the number of minutes from now the aircraft will be number 1 and ready for departure. Alternatively, you can enter a number of minutes and click |+|
  - After clicking |+| you will need to confirm it with the right arrow
- Review 'best practices' at the end for technique for good timing





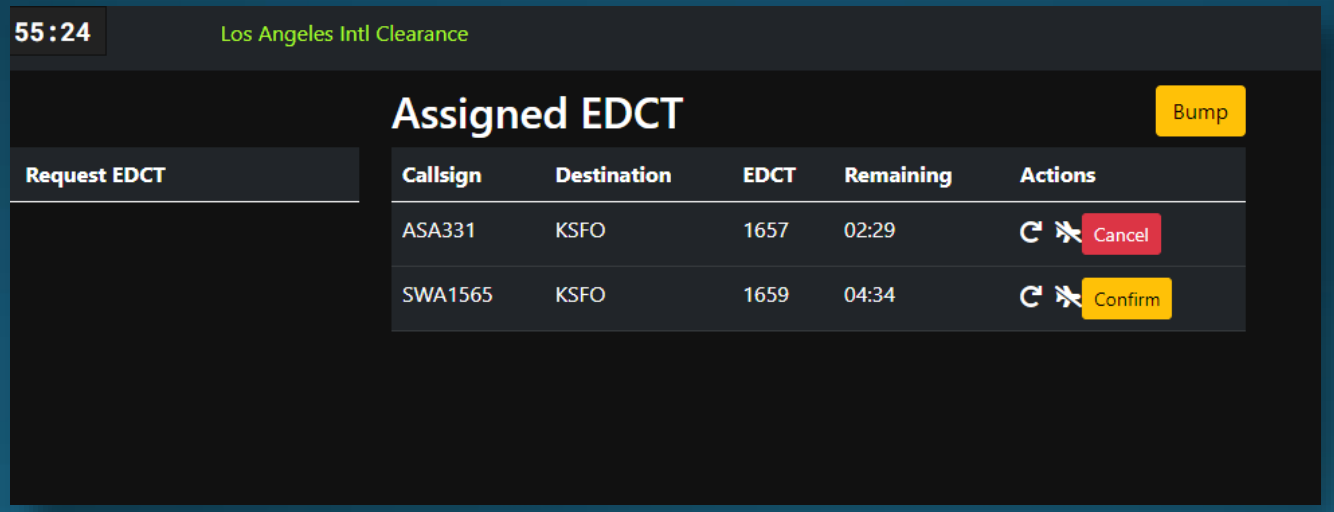
CalFLOW for ATCT

- Generally, it is best to assign wheels up times after issuing taxi instructions
- If aircraft end up at the departure runway out of sequence from CalFLOW, or in a calculated sequence by ground control, times may be swapped easily using the 'swap' feature
  - To swap, just click 'swap' and the confirm the flight you wish to swap the time with
- If wheels-up times are not being met by Local Control, the times may be bumped (pushed back) easily by using the bump feature
  - Note: if 'Bump' is used, some aircraft may be bumped by more than the requested amount of time due to overflight slot limits



CalFLOW for ATCT

- Note on this page the Estimated Departure Clearance Time (EDCT) and minutes remaining until that time
- Again, at most facilities this time can be met by Local Control +/- 2 minutes
  - This means you should try to depart the aircraft at T=2:00 remaining
  - At T=zero, time remaining will turn amber, and red at T= -2 if the window is missed



CalFLOW for Enroute

Now it's time to see the results. This is a TMU ladder, or TMU stack

- Symbology
  - The ladder itself is oriented with a merge point on a specific STAR or stream at the bottom - at the current time, with time increasing above
    - Note: the ladder name reflects the important merge point on a stream, not necessarily the STAR name
  - The left side of each ladder reflects flights *actual* positions on the stream in real-time (green flights)
  - The right side of each ladder is the corresponding requested position by TMU (yellow flights). This can be changed
    - A green or grey number indicates the number of minutes a flight should be slowed or sped up to meet the requested time

CalFLOW for Enroute

- The requested times can easily be moved by double-clicking the yellow flight number and adding or subtracting minutes
- Managing traffic on the stack
  - If a flight needs to lose time (move up the stack), it will be indicated by a green number of minutes to be lost – and the flight should be slowed or vectored for metering
  - The opposite is true for a flight needing to gain time, of course
  - Keep in mind acceleration is only good for a minute or two of time gain

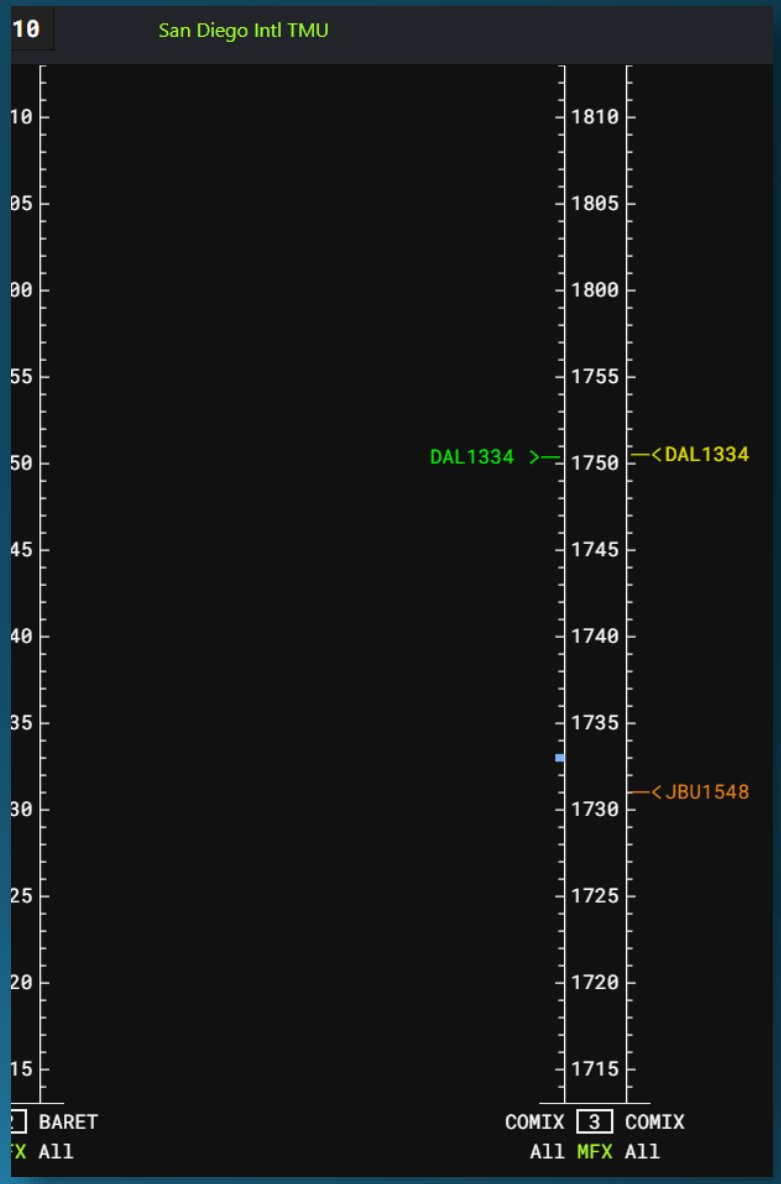
CalFLOW for Enroute

One of the most beneficial aspects of CalFLOW is the ability for Enroute to actually see where aircraft *ON THE GROUND* will fit into their stream

- On the assigned time side of the ladder, an orange flight indicates a departure from a field below with an assigned wheels-up time, and it lies where the real flight should fall in
  - In this example, JBU1548 is a LAX departure to SAN with a flow time of 1716Z
  - The departure time is irrelevant to CTR as the orange time is simply where the flight will end up

NOTE: The green *actual* flight will only show up when the flight is airborne and meets certain parameters

- Once the green *actual* shows up, it will initially be behind where it's supposed to be as it is still accelerating to speed and into its slot



Best Practices

General

- Be conservative! Issue times that have extra slack built in. Remember that Tower can let aircraft go 2 minutes early

Ground Control

- Only assign wheels-up times after aircraft have been given taxi instructions – unless a need exists during an event where there are seriously long waits
  - Keep in mind VATSIM pilots have no experience timing their pushback and taxi to arrive at the departure runway at a specific time – don't expect them to
  - IRL, flow times are often issued at the gate for small-airport departures. Not recommended here
- When starting to use CalFLOW, you will likely assign times that turn out to be difficult to meet, so build in at least two minutes *from what you think will work* for extra for wiggle room
- It is your job to ensure Local Control can reasonably meet the departure times
  - If an aircraft needs to wait, use alternative taxi routes and locations to hold aircraft on the ground

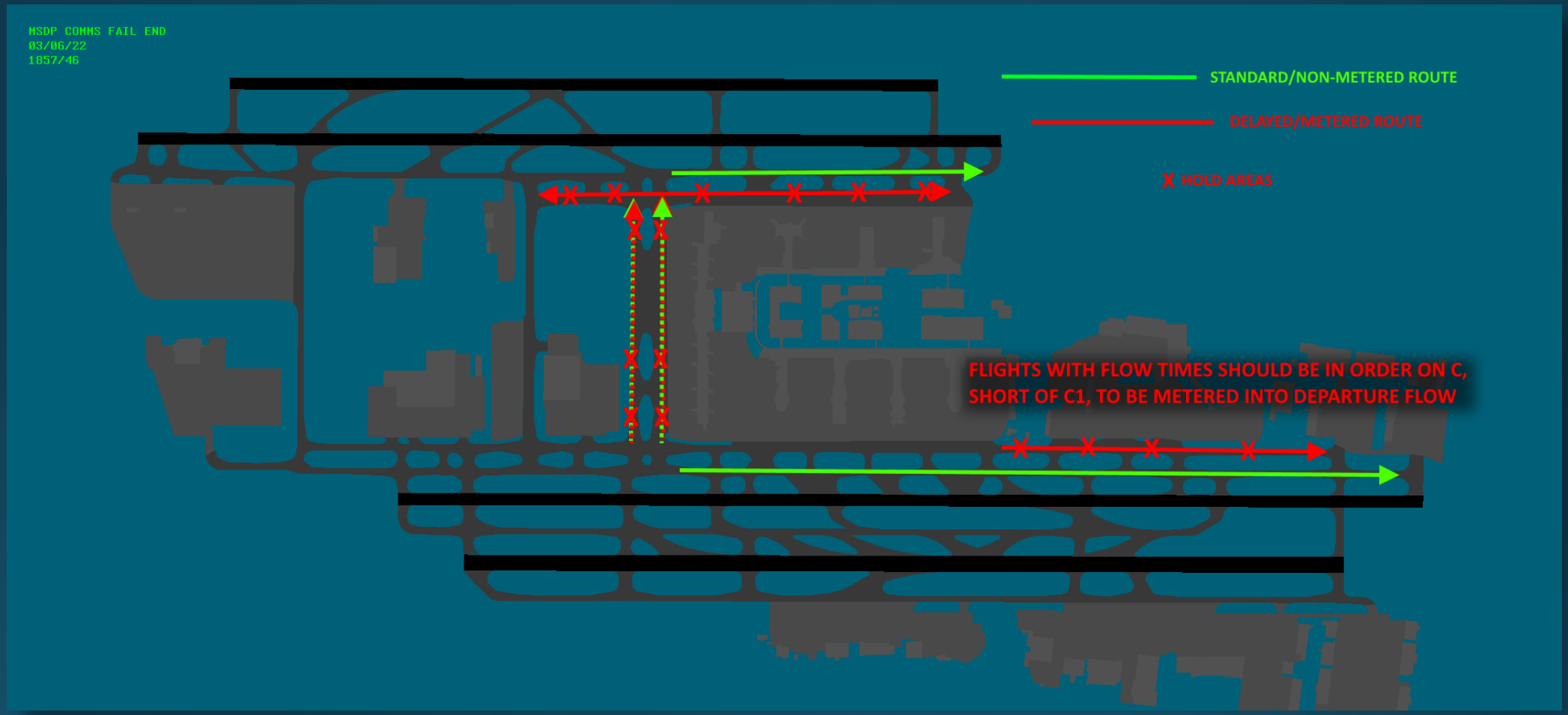
Best Practices

Local Control

- Workload permitting, assist Ground Control in assigning or amending departure times that will work for you
- If you receive an aircraft at the departure end of the runway, launch them 2 minutes early unless your facility prevents it
  - This means that you can say the words "cleared for takeoff" at exactly 2 minutes prior to the assigned wheels up time – you can even "line up and wait" earlier
  - This will help you stay ahead of potential delays, and keep your runways moving planes

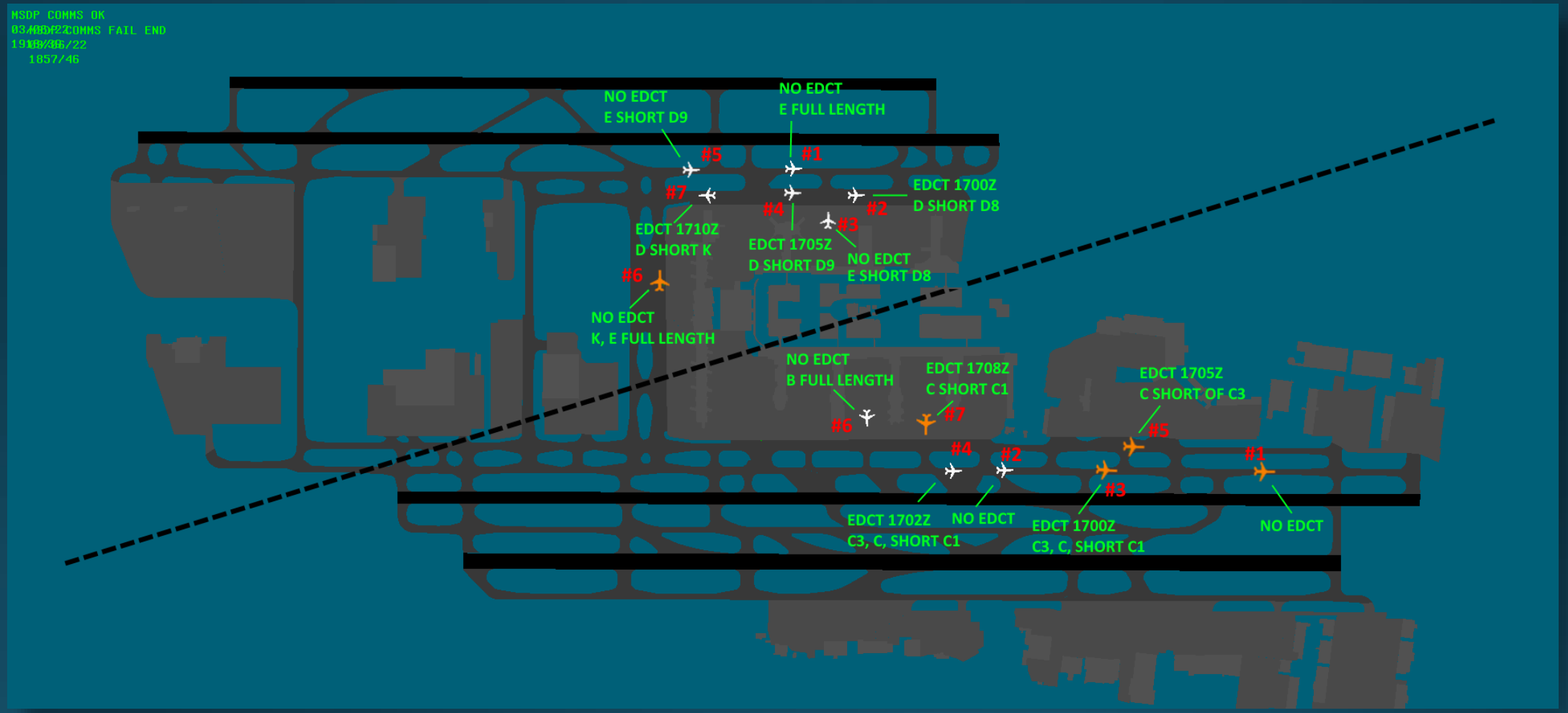
Best Practices

LAX Ground taxi routings for metered departures



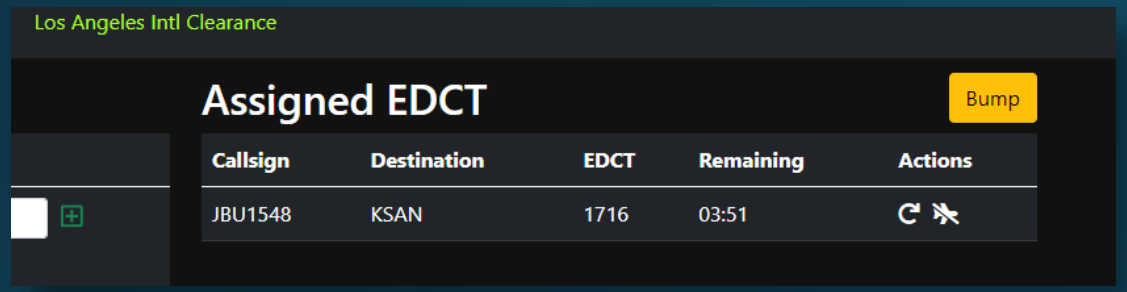
Best Practices

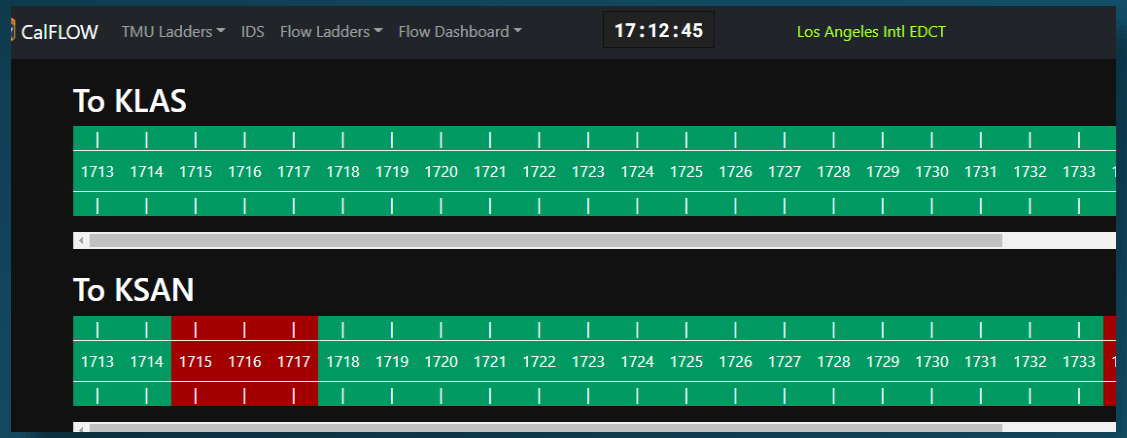
LAX Ground sequencing example

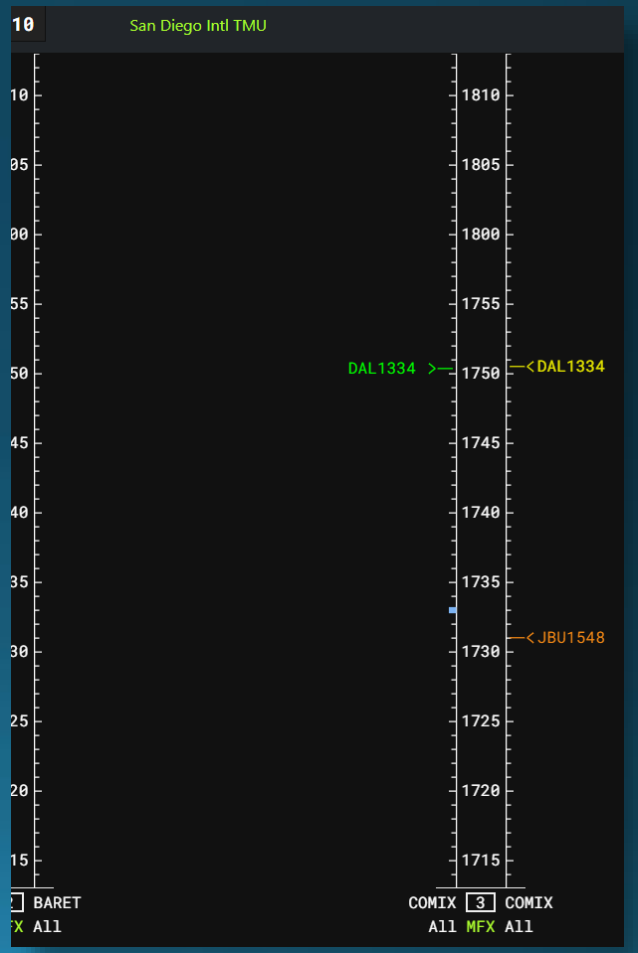


Bringing it all together

This is an example of a departure from LAX to SAN with an assigned wheels up time, and how it corresponds throughout CalFLOW







Go forth and praise #theFLOW™

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