

ZOA'S GUIDE TO CONTROLLING PROFICIENTLY AT SAN FRANCISCO TOWER

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Though this guide was published primarily for our students, it doesn't really matter where you are in your training; you could be an S1 or a C3. It always pays to brush up on your basic skills, no matter how much more advanced you may be. In addition, SFO Tower is ZOA's busiest tower facility, so when it's time to get down and dirty, it pays to know what you're doing. In this guide, we start with Clearance and work our way up. Keep in mind that the real benefit of this guide will come by reading all of it in detail; not glossing.

NOTE This guide assumes that only SFO_TWR and a departure controller are online (no DEL or GND). It also assumes that you are familiar with basic functions of the VRC program; generally, key commands will not be covered here. This guide is a supplement to the official ZOA syllabus, not a replacement. The guide assumes that the reader is familiar with ZOA's SOPs.

Clearance/Flight Data

Your job

As the Clearance Delivery/Flight Data position (SFO_DEL), your job is to review each departing aircraft's flightplan and deliver the corresponding clearance.

Example

As a clearance controller, there are several key phrases you should learn: telling an aircraft to wait for his clearance, correcting a flightplan, delivering the clearance, and confirming the clearance.

Before we begin our in-depth learning, let's start with an example. Our example aircraft will be United 830 who is requesting clearance from SFO-LAX.

Person	Phrase	Remarks
UAL830	Tower, United 830 IFR to Los Angeles.	
SFO_TWR	United 830, San Francisco Tower, clearance on request [if necessary, you can add his number in line: "you're number four"]	If you have the clearance ready, there's no need to say that it's on request; just jump right into it.
SFO_TWR	United 830, clearance available, advise ready to copy	
UAL830	Ready to copy, United 830	
SFO_TWR	United 830, cleared to Los Angeles airport via the PORTE3 departure, Avenal transition, then as filed ; maintain 5,000, expect FL330 10 minutes after departure; departure frequency 135.1; squawk 3304	You must add "airport" because it specifies the clearance limit; otherwise you could be clearing him to the LAX VOR or some other navigational fix.

		-- See reference for "then as filed" below.
UAL830	United 830 to Los Angeles via the PORTE3, Avenal, as filed; 5,000, 330 in 10, 135.1 and 3304	He might not use proper phraseology but you still have to.
SFO_DEL	United 830, readback correct. Altimeter 30.02. Expect runway 1L , advise ready to taxi.	If he had reported in with the current ATIS, you wouldn't have had to give the altimeter. Otherwise, you must give it. -- See 'Ground Control' section on assigning runways.

Types of phraseology are listed below along with when to use them.

Elements of a clearance

CRAFT

Your clearances should always follow the CRAFT format:

Cleared to (clearance limit)	Where are you clearing the aircraft to?
Route	What route should he follow?
Altitude	What is his initial altitude and his cruise altitude?
Frequency	What is the departure frequency?
Transponder	What is his transponder/squawk code?

C: Cleared to/Clearance limit

Where is he going? Where should you clear him?

IFR For IFR aircraft, clear them to their filed destination airport. Be sure to always add the word "airport" in your clearance, otherwise it is not clear if they are cleared to the Los Angeles Airport or the Los Angeles VOR or some other navigational fix (e.g. Cleared to Las Vegas *airport*, Palo Alto *airport*, Seattle Tacoma *airport*, etc.).

VFR You do not generally clear a VFR aircraft to an airport, but rather into/out of your airspace. Because SFO is a Class Bravo airport, you will always use the phrase "Cleared into the Bravo airspace." More on VFR techniques later.

R: Route

How is he getting to his destination? It differs between IFR and VFR operations. You should keep in mind that aircraft will often file partially or completely incorrect routes; we'll cover amending routes shortly.

IFR For IFR aircraft, you will almost always clear them via published DPs (Departure Procedures). More on how to determine proper DPs and routes shortly. Note that reading a clearance differs slightly between aircraft departing and arriving in the same ARTCC (ZOA, in this case) and departing and arriving in different ARTCCs (ZLA, ZSE, ZLC, etc.).

VFR Again, you do not generally clear VFR aircraft to a destination, but into or out of your Bravo airspace. The route will usually be departure instructions, such as to fly runway heading or depart on a left crosswind or right downwind, etc.

A: Altitude

How high? Again, the procedures differ between IFR and VFR departures.

IFR All IFR departures out of SFO filing for 5,000 or higher as a cruise altitude, unless otherwise specified by the departure controllers, shall be assigned an initial altitude of 5,000 as per SOP. Aircraft filing for lower altitudes (e.g. 4,000) shall be cleared to that altitude. Generally, however, most departures will have filed for an altitude higher than 5,000, in which case you should tell them to expect their final cruise altitude either 5 or 10 minutes after departure (the time varies by DP; look at the chart to see whether it is 5 or 10 minutes).

VFR VFR departures will be assigned either a solid altitude, an at-or-above altitude, or an at-or-below altitude to maintain. Through coordination with your departure controller and an analysis on your part of regular IFR traffic at SFO, you can determine what altitude to assign an aircraft until it is out your airspace.

As a clearance controller, you must also know what constitutes a valid altitude for direction of flight.

IFR Direction of flight between 001°-179°: Odd altitude (3,000, 5,000, 13,000, FL190, FL230, FL290, FL370, etc.)

Direction of flight between 180°-359°: Even altitude (4,000, 8,000, 14,000, 16,000, FL180, FL240, FL360, etc.)

Flight Levels: You may have noticed that some altitudes are written with the letters "FL." Beginning at 18,000 feet MSL, altitudes are called flight levels. 18,000 is FL180 ("flight level one eight zero"), 20,000 is FL200 ("flight level two zero zero"), 35,000 is FL350 ("flight level three five zero"), etc.

VFR Direction of flight between 001°-179°: Odd altitude plus 500 (3,500, 5,500, 13,500, etc.)

Direction of flight between 180°-359°: Even altitude plus 500 (4,500, 8,500, 14,500, etc.)

Flight Levels: VFR aircraft do not use flight levels because at and above 18,000 feet MSL, you must operate under an IFR flight plan. 17,500 is generally the highest altitude a VFR aircraft may file for or fly.

F: Frequency

What is the aircraft's departure frequency? Assign the frequency of an approach controller controlling SFO departures, or, if one is unavailable, OAK_CTR. If neither an appropriate approach nor center controller is online, do not assign a departure frequency.

Controller available "Departure frequency 135.1" or "Departure frequency 135.65" or "Departure frequency 132.2"—there is no need to say the name of the facility, just the frequency.

Controller unavailable "Departure offline" should be used.

In some cases, there may be multiple approach controllers online and you may not know what the proper frequency is. The best course of action to take is to ask! Use the ATC channel (type "/" (slash) followed by your message, which might be something like, "/who controls SFO departures?") or private message individual controllers. Generally, in normal ops STS_APP and/or CCR_APP will control SFO departures. Generally, in east ops, HWD_APP will control SFO departures. Otherwise, if STS/CCR/HWD is not online, SFO_APP controls SFO departures. More about normal ops/east ops in the "Ground Control" section.

T: Transponder

IFR aircraft are always assigned a transponder code. When operating in Bravo airspace, VFR aircraft are also usually assigned a squawk code. So generally, you can assume that anything departing SFO should be issued a squawk code. Issue a squawk code by pressing F9+ASEL or clicking "Assign Squawk" in the flightplan window of the aircraft in question.

As a clearance controller, there are several key phrases you should learn: telling an aircraft to wait for his clearance, correcting a flightplan, delivering the clearance, and confirming the clearance.

Clearance idiosyncrasies

IFR

In an IFR clearance, for the route, you will always say the name of the Departure Procedure followed by the appropriate transition (e.g. "via the PORTE3 departure, Avenal transition...") and then say "then as filed" ("via the PORTE3 departure, Avenal transition, then as filed..."). However, when a flight arrives in the same ARTCC in which it departs (ZOA), you must read the route in its entirety. If this route ends with a STAR, read the name of the procedure (e.g. "via the San Francisco Eight departure, radar vectors Concord, Concord One Arrival..."). If this route ends with a VOR or other navigational fix, read the name of the fix, then say "direct" (e.g. "via the San Francisco Eight Departure, radar vectors Sacramento, direct..."). As a general rule of thumb, read the portion of the route in ZOA and then say "then as filed," or read the route in its entirety if the arrival airport is also within ZOA.

Unfortunately, there's another idiosyncrasy that you should know about. That's the difference between Pilot Nav and radar vector departures. Pilot Nav departures have the entire procedure charted, whereas radar vector departures involve a vector from a departure controller. The difference to you is only slight, however. For Pilot Nav departures, say the name of the departure and the name of the transition followed by the word "transition" (e.g. "PORTE3 departure, Avenal transition..."). For radar vector departures, say the name of the departure, the words "vectors to," then the name of the transition (e.g. "SFO8 departure, vectors to Red Bluff...").

How do you know if it is a Pilot Nav or vectored departure? For SFO, all departures are listed in a table below. You can also always tell by looking at the chart. On NOS charts (those available on AirNav, SkyVector, and other online sources), if the textual description includes "transitions," it is a Pilot Nav departure, whereas if no transitions are listed, it is a vectored departure. On Jeppesen charts (generally available only at a cost online or as a paper subscription), Pilot Nav departures contain a graphic depiction of each transition with a textual reference (e.g. "PORTE3.CZQ) on the dotted black line. Many vectored departures on Jeppesen charts say "vector" in the title.

VFR clearances

IFR aircraft are cleared to specific destinations along specific routes and at specific altitudes. VFR aircraft, on the other hand, are not cleared to a destination, but into or out of your airspace. Nevertheless, you are still giving a clearance and should use the CRAFT format. Bravo airspace is very restrictive, given the volume and type of traffic (high volume, IFR, fast jets), so VFR aircraft are still given somewhat specific instructions.

C: Cleared to/Clearance Limit

You are clearing the aircraft into the Bravo airspace, as the plane will obviously need to enter Bravo airspace to depart the airport. *"Cleared into Class Bravo airspace..."*

R: Route

No, you won't be providing a charted Departure Procedure to follow, but you still can tell the airplane how to enter or leave your airspace. Determine to what airport, or at least in what direction, the aircraft will be initially traveling. From there, determine what runway he will be using and make an appropriate decision as to how you would like the aircraft to depart. While you could theoretically assign a heading to fly after departure (try not to do this, more on this later), you could also use standard VFR phraseology and have the aircraft depart on a leg of the traffic pattern. How will you make this judgment? Say, for example, the aircraft is parked at Signature Flight Services (or General Aviation parking) on the northwest side of the field. It is reasonable to expect that you will taxi the aircraft to depart on 28R. Given that 28R points in a westerly direction, you can make a decision as to how your aircraft should depart. If the plane's direction

of flight is north, a right crosswind departure would be suitable; south, a left crosswind departure; east, a right downwind departure; west, a straight out departure. Always coordinate your intentions with the departure controller. *“Expect a right downwind departure...”*

A: Altitude

Unlike IFR departures, there is no one proper altitude to assign for VFR departures. As the tower controller, you may assign an at-or-above altitude, an at-or-below altitude, or a hard altitude to maintain. Given that you have jet and other IFR traffic climbing to 5,000 and other IFR traffic arriving, determine an altitude. Generally, lower is better. On a very busy day, 5,000 would not be the best altitude to assign. On an empty day, perhaps you can assign the requested cruising altitude. Generally, lower is better as a low altitude is less likely to conflict with IFR traffic. The plane can always climb to its cruising altitude once it has been cleared to do so by departure or once it has exited Bravo airspace. *“Maintain VFR at or below 1,500...”*

F: Frequency

Know the Bravo airspace and consult a chart if needed. If a departure controller is online, it is generally prudent to assign that frequency to the aircraft and have the aircraft contact the departure controller shortly after wheels-up so that TRACON can coordinate the exiting of Bravo airspace. *“Departure frequency 135.1...”*

T: Transponder

To operate in the Bravo airspace, all aircraft should be on a discrete beacon code. Additionally, SFO_TWR often maintains a radar track on aircraft, often requiring a discrete beacon code anyway. Assign a squawk code to all aircraft. *“Squawk 3310.”*

Now, put together the italicized pieces in each of these elements, and voila! The CRAFT formula really does work. Let’s see what an example clearance looks like all together: *“Cessna 2457V, cleared into Class Bravo airspace, expect a right downwind departure, maintain VFR at or below 1,500, departure frequency 135.1, squawk 3310.”* And that’s all there is to it.

IFR routes and departure procedures

Knowing the CRAFT formula, you might think delivering IFR clearances is easy. After all, you just read the route in the flightplan, right? Well, not exactly. Half the job, and more than half, sometimes, is correcting improperly filed flightplans—anything could be wrong, from the spelling of the destination airport, to, most often, the altitude or route. It is your job to catch and correct these errors as the Clearance controller, because remember: even though you’re “just” giving clearances, how you clear an aircraft has repercussions from Tower all the way to Center. And when there are mistakes in the route or altitude, people are going to be looking at you for answers. So the rules for altitude assignments are written above. Now how about routes?

Learning correct routes takes mostly practice. One of the best ways to see if a route is correct is to check SimRoutes (simroutes.com) or check out the preferred routes on the ZOA website. Almost all routes between SFO and other Class B or C airports are on SimRoutes; however, what if someone is departing at SFO and arriving at a small Class D field or an uncontrolled field, or another smaller airport outside of ZOA? Well, the smartest thing to do is to plug in a large airport nearby into the arrival airport field on the SimRoutes website, and from there you’ll at least know the departure procedure and most of the route up until the STAR.

We won’t go on in more detail about choosing routes like that; you and your mentor should have a good discussion about routes. We will, however, cover all of SFO’s departure procedures (DPs). You need to know which ones go where and when to use them—otherwise, how good of a clearance controller are you?

Theoretically...

Here's an interesting bit of information that you *won't* use here on VATSIM. Remember CRAFT? Well, in certain circumstances, you are allowed to omit part of the A and the F. That's because certain departure procedures carry this information and it's written on the procedure (the departure frequency and how long after departure to expect the final cruising altitude). For example, if you were clearing someone on the SFO8, you could simply say, "United 830, cleared to Denver via the SFO8 departure, vectors Linden, as filed, maintain 5,000, squawk 3334." However, you could only say that assuming that an approach sector with the frequency 135.1 was online and controlling SFO departures and if the pilot were quite proficient. Thus, on VATSIM, for now, don't use this abbreviated clearance format; it will usually just confuse the pilots. Stick to the full, tried and true CRAFT.

DP Name	Runways	Use	Comments
Dumbarton Six (DUMB6)	10L/R, 19L/R	North, East, and South departures (RBL, SAC, LIN, OSI)	
Eugen Five (EUGEN5)	1L/R, 28L/R	South departures (BSR, SNS)	
Gap Three (GAPP3)	1L/R, 28L/R, 10L/R	West departures (Hawaii, Asia, etc.)	Vector departure
Luvve Two (LUVVE2)	10L/R, 19L/R	Various directions, vector from LUVVE	Vector departure
Molen Three (MOLEN3)	10L/R, 19L/R, 28L/R	North, West departures routed via ENI	
Offshore Five (OFFSH5)	1L/R, 28L/R	South departures (FLW, RZS, GVO, SXC)	
Porte Three (PORTE3)	All	South, southeast departures (FLW, AVE, PXN, CZQ)	
Quiet Two (CUIT2)	1L/R, 28L/R	North, East departures (ENI, RBL, CIC, SAC, LIN)	Noise abatement
Rebas Three (REBAS3)	1L/R, 28L/R	North, northwest departures (ENI, RBL, CIC)	Prop aircraft
San Francisco Eight (SFO8)	1L/R	North, east departures (RBL, SAC, CCR, LIN, ECA)	Vector departure. Generally for use on 1L/R (use SHOR1 for 28L/R)
Shoreline One (SHOR1)	28L/R	North, east departures (RBL, SAC, LIN)	

Ground control

Your job

As the Ground controller (SFO_GND), your job is to safely and efficiently taxi aircraft from the ramp area to the runways and the runways to the ramp. Based on wind direction/speed and other factors, you must determine the runway use program at SFO.

What's in use

It is your job to determine SFO's runway use configuration based on a number of variable factors: predominantly the winds, but also factors such as time of day, etc. This guide will not cover proper configuration selection because that information is available in the ZOA Primary Airports SOP.

The set-up

SFO is unique in that it has four parallel and intersecting runways, and more often than not, four runways are in use. This guide will assume that SFO is in normal ops (1L/R for departures; 28L/R for all arrivals and heavy and oceanic departures). Operating in such a configuration can be confusing. Have an airport diagram! Don't just rely on the VRC display.

Assigning a runway

This section arguably should have been in the Clearance Delivery portion of this guide since the Clearance controller often tells an aircraft what runway to expect. However, we'll leave this section here for now. Remember that we're in normal ops. So what goes into assigning a runway? A number of factors, actually. The departure procedure affects the runway, and vice-versa. Other important factors include aircraft weight and direction of flight.

The first factor is easy enough to solve. Each departure procedure has a list of available runways on it. If the departure procedure doesn't have instructions for the runway you want to assign, pick a new DP or a new runway. That may or may not narrow down your choices.

The second factor is aircraft weight. An aircraft's size and consequently its weight affect its takeoff distance. Let's look at the runway lengths at SFO. 1L is the shortest, followed by 1R, then 28L, and finally, 28R is the longest. Most heavy aircraft will require 1R or runways of greater length. Many other aircraft should routinely be able to accept 1L.

The third factor is direction of flight. More accurately, the third factor is the initial direction of the departure procedure. Amid all the jumbled text and graphic depictions of departure procedure diagrams, all departures have this in common: Just after takeoff, every departure procedure will involve a straight-out course, a left turn, or a right turn. The PORTE3, for example, involves a left turn after departure, whereas the SFO8 calls for a right turn after departure. According to whether the procedure brings the airplane straight-out, left, or right, assign a corresponding runway. Thus, off of 1L/R, PORTE3s should generally be assigned 1L when possible with aircraft weight, and SFO8s should generally be assigned 1R. This way, Tower is able to launch two parallel departures at the same time, knowing that they will turn away from each other rather than converging courses. However, sometimes a departure might be an immediate left turn followed by a right turn several miles later, so it's important to at the departure procedure itself. Different circumstances will call for different procedures. Generally speaking, PORTE3 departures should be assigned 1L/28L, SFO8 departures should be assigned 1R.

Getting to the runway

Now that you've chosen a runway, how do you get the airplane there? You tell the airplane to taxi there. But there is specific phraseology that must be used in various situations. These situations are covered below.

Phraseology

The words "taxi to": The words "taxi to" in a taxi clearance carry a special implication. An aircraft that is told to "taxi to" a runway and given a taxi route is assumed to be cleared to cross all runways on that route except for the assigned runway itself. This rule is especially important at a field like SFO because the moment you say "United 830, taxi to 28L via Alpha, Foxtrot," United 830 is authorized to cross 1L and

1R without asking anyone. On the other hand, when you say “Skywest 6334, taxi to 1L via Bravo,” you don’t have to worry given that there are no runways on that taxi route. So the formula for a standard taxi clearance is DESTINATION RUNWAY, VIA TAXIWAYS. *Frontier 663, taxi runway 1R via Alpha.*

Hold Short taxi instructions: Let’s revisit that scenario wherein you have an aircraft taxiing to 28L. This guide assumes we’re in normal ops, so 1L/R are being used for departures. As this is the case, you must have this aircraft hold short of 1L/R. The phraseology for a hold-short taxi instruction is DESTINATION RUNWAY, VIA TAXIWAYS, HOLD SHORT INSTRUCTIONS. *United 830, runway 28L, taxi via Alpha, Foxtrot, hold short runway 1L* or *FedEx 501, runway 28R, taxi via Charlie, hold short runway 19R.* Note that you do NOT say “taxi to 28L;” you say the runway and then “taxi via...” You may also use the Hold Short instruction if you want an aircraft to hold short of a taxiway along the route. *Delta 1812, runway 1L, taxi via Bravo, hold short taxiway Golf.*

Taxi to the ramp instructions: Since on VATSIM we have neither ramp control nor pre-assigned/reserved gate spaces, we just give instructions to taxi to “the ramp.” It’s quite easily done. If there’s no conflicting traffic in the ramp area or on the taxiways, just say, *“taxi to the ramp.”* If you want the aircraft to taxi on a specific taxiway (they really have only two big-picture choices, Alpha or Bravo), say, *“taxi via Alpha to the ramp”* or *“taxi via Bravo to the ramp.”*

Give way instructions: When it’s busy, or sometimes when it’s not busy, it will be necessary for you to give “give way” instructions. For example, you might have an aircraft taxiing on Alpha to cross 1L and 1R for 28L (call him AAL1500) and another on Bravo taxiing to 1L (call him SKW6387). If their paths will intersect, you get to decide who goes first. Either say *“American 1500 heavy, give way to the Skywest Brasilia passing your left to right”* or, if you want it the other way around, say, *“Skywest 6387, give way to the American 767 passing right to left, then continue taxi.”* “Give way” instructions might need to be used in a variety of scenarios, and now you know what to do.

Monitor Tower

In this particular section, and this section only, let’s assume that you’re SFO_GND (not SFO_TWR) and that another person is operating SFO_TWR.

As a ground controller, you should tell aircraft taxiing to runways to monitor the Tower frequency once they approach the runway. For runway 1L/R departures, as the aircraft pass taxiway Golf on Alpha or Bravo, issue this instruction: *“Continental 255, monitor tower 120.5.”* Note that we’re telling the aircraft to *monitor* and not *contact*. The difference is as simple as it sounds. Translation: “Continental 255, change to tower frequency but don’t check in with tower; tower will check in with you.” That leaves the Tower frequency clear of clutter and enables the tower controller to process aircraft more efficiently.

The same Monitor Tower instruction should be used for aircraft bound for 28L/R who must cross 1L/R. As these aircraft pass Delta on Alpha or Bravo, issue the instruction, “Japan Air 1 heavy, monitor tower 120.5.” It is Tower’s responsibility to issue these aircraft the clearance to cross 1L/R. Tower also owns taxiway Foxtrot, and Tower will not change aircraft back to the ground frequency once they cross 1L/R. The same technique should be used for aircraft taxiing from the northwest side of the field to 28R. As they pass Delta on taxiway Charlie, issue the Monitor Tower instruction. Tower owns taxiway Charlie east of 1L, as it owns taxiway Foxtrot.

Common Taxi Routes in Normal Ops

Origin	Destination	Route
MAIN ramp area, commercial gates (Southwest side of field)	1L	B or A+M
MAIN ramp area, commercial gates (Southwest side of field)	1R	A
MAIN ramp area, commercial gates (Southwest side of field)	28L/R	A+F, Hold Short 1L

CARGO/general aviation ramps (Northwest side of field)	28R	C, Hold Short 19R
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Tower/Local

Your job

As the tower/local controller (SFO_TWR), your job is to sequence takeoffs and landings in a safe and efficient manner, and to provide appropriate field and cautionary advisories to inbound and outbound aircraft. You will also coordinate and handle airspace transitions.

Your airspace

When handling VFR aircraft or VFR transitions, it's useful to know something that most people don't think about. SFO_TWR airspace extends laterally in an approximately 5 mile radius from the center of the field, and vertically from the surface to 2,000 feet MSL. Of course, hand IFR departures off immediately to departure control; you don't need to wait for them to get to the edge of your airspace.

Departures/Takeoffs

One of your primary responsibilities is to appropriately sequence departures.

Monitor Tower

If you do have a GND controller online, he or she has told your aircraft to *monitor* Tower, not contact you (see above section for more details). This leaves you with less frequency congestion. However, you must remember that it is *your* job to make initial contact (provided, of course, that the aircraft doesn't ignore the monitor instruction and contact you first). An initial point of contact might be *Freeze 69, San Francisco Tower, hold short runway 1L* or *Amanda 69, San Francisco Tower, runway 1R, position and hold for traffic*.

Taxi to 28

It's your responsibility to get airplanes bound for 28L/R across 1L and 1R. Remember, you make initial contact with the aircraft. Depending on what the situation is on runways 1L/R, tell the aircraft to hold short of 1L, cross 1L and hold short of 1R, or cross 1L and 1R. If the aircraft is going to 28L, then say "taxi to 28L" and if the aircraft is going to 28R, say "hold short runway 28L." Examples: *United 837 heavy, San Francisco Tower, on Foxtrot, cross 1L, cross 1R, taxi to 28L* or *Japan Air 1 heavy, San Francisco Tower, cross runway 1R, hold short runway 28L* or *All Nippon 7 heavy, cross 1L only, hold short runway 1R for departing traffic*. You can always lightly remind them to hurry up in their crossing by saying something like *No delay in your crossing, traffic holding in position*.

Hold Short/Position and Hold Phraseology

Hold short: The hold-short instruction is implied in the taxi clearance. If, for whatever reason, you must tell an aircraft to hold short of the runway, it's as simple as HOLD SHORT [RUNWAY NUMBER]. *Skywest 6115, hold short runway 1L*. If you wish, you may include a reason for the hold short instruction: *Eagle Flight 104, hold short runway 28L, landing traffic*. Do remember that it isn't only for departures that you will use the hold short instruction. If an aircraft is arriving and lands on 28R, you may need it to hold short of runway 28L for landing or departing traffic (reference is EGF example in this paragraph).

Position and hold: To place an aircraft into position and hold, say [RUNWAY NUMBER], POSITION AND HOLD, [REASON/ADVISORY]. If you're an approach controller, you know that when you give a heading

to fly, you try to include a reason for the vector. The same applies for a position and hold clearance. All you say is the aircraft callsign, runway number, "position and hold," with a reason and/or advisory. What are some reasons? Wake turbulence, departing traffic, landing traffic, crossing traffic, awaiting release, etc. What are some advisories? Wake turbulence, the position of approaching traffic, another remark, etc. Here are some examples: *Delta 1512, runway 1L, position and hold, traffic on a six mile final a heavy Airbus* OR *United 8131, runway 1R, position and hold, traffic landing west* or *Skywest 6242, runway 1L, position and hold, caution wake turbulence*. You can keep it simple and sweet and just say "*position and hold for traffic,*" or something to that effect. You get the idea. If you're too busy or if there is frequency congestion, don't worry about providing a reason, just get the aircraft in position.

Takeoff Phraseology

The Formula: WAKE TURBULENCE/ADVISORIES + WIND + CLEARED FOR TAKEOFF. In some cases, the order can shift around a bit for fluidity or importance.

Wake Turbulence: We won't cover what wake turbulence is; that information is in the general training syllabus. We will, however, cover how to issue a wake turbulence advisory. CAUTION WAKE TURBULENCE + AIRCRAFT. *United 1512, Caution wake turbulence from the heavy 767 3 mile upwind* or *Skywest 6387, Caution wake turbulence, 757 departing the parallel*.

Other Advisories: There are a number of advisories that you may wish to include in your takeoff clearance. We just covered wake turbulence; a related advisory is a jet blast advisory: *Frontier 1912, Caution jet blast from the heavy jet crossing downfield*. You may wish to tell an aircraft to "hurry up." In this case, use the words "no delay": *American 15 heavy, no delay, traffic inside a 3 mile final*. You might wish to let an aircraft know that a sideby departure will not be a factor: *Horizon Air 2525, traffic departing the parallel will turn away* or *Tag 504, traffic departing the parallel diverging course*. (Credit to Inigo Markle-Allen on the "diverging course" phraseology tip). You get the idea.

So a full blown takeoff clearance might sound something like this: *United 122, traffic a heavy jet 3 mile upwind, caution wake turbulence, wind 010 at 4, runway 1R cleared for takeoff, no delay please, traffic on a 2 and a half mile final*. That's about as complex as it gets. However, when there aren't conflicts and issues, it can be as simple as *United 122, runway 1R, cleared for takeoff*.

Using Position and Hold

Use the position and hold instruction to your advantage to maximize efficiency. You're lucky that you still have it! Position and hold has been removed from and restricted at many airports. So why use it? So that the aircraft is on the runway and ready to go by the time you issue the takeoff clearance. As soon as you clear one aircraft to takeoff on a runway, you can clear the next aircraft in sequence to taxi into position and hold almost immediately after. Do not, however, hold an aircraft in position if you don't need to—if you can clear an aircraft for takeoff, do so! Phraseology for position and hold operations is reviewed above.

Since this guide was first written, some new rules regarding taxi into position and hold (TIPH) have come into effect. For our purposes, nothing changes when putting aircraft into position and hold on runways 1 during normal ops. However, when an aircraft is holding in position on runways 28, you may not clear an aircraft to land on the same runway until you have cleared the holding aircraft for takeoff (you would tell the aircraft on approach to "continue"). However, ZOA mentors and instructors will not penalize you for not adhering to this rule during an OTS or mentor session, so don't give this rule too much attention.

The Runway 1/28 Dilemma

Being the SFO local controller is most challenging in a high density traffic situation because you must manage parallel, perpendicular, crossing runways. You're departing aircraft off of 1L/R, departing a few on 28L/R, and landing aircraft on 28L/R. So how do you know much leeway you have and how close is too close to launch departures? As a general rule of thumb, if you have traffic in position and ready to go on 1L/R, you may release it with westbound landing traffic (runways 28) on no less than a 2.5 mile final.

If you're a new controller or you have a new pilot that isn't very fast in complying with instructions, make your minimums higher, like a 3 mile final for westbound landing traffic. It is considered an operational error if westbound landing traffic is over the threshold of 28L/R when or before the departing aircraft crosses the intersection of the 1 and 28 runways in question. As a side note, though this guide covers normal ops only, if you are departing 10L/R and landing 19L/R, you may launch the departure with southbound landing traffic on no less than a 3 mile final (3, not 2.5, because the distance from the approach end of the departure runway to its intersection with 19 is greater).

Contact Departure

As soon as you see a positive rate of climb, tell the aircraft to contact departure. *Inigo 69, contact Norcal Departure* or *Flanoory 414, contact departure* or *Car Man 421, contact Norcal*. Unless you foresee confusion or unless the aircraft asks, there is no need to say the frequency, as that was provided in the initial clearance.

Departure separation minimums

Don't worry about the specifics below until you can talk about them with a mentor or instructor.

Wake Turbulence

CAT I Small aircraft 12,500 lbs or less with single engine prop, all helicopters
CATII Small aircraft 12,500 lbs or less with twin engine prop
CATIII All other aircraft

Departure Separation – Same Runway

Both CAT I aircraft involved	3,000 feet
CAT I preceded by CAT II	3,000 feet
Both CAT II aircraft involved	4,500 feet
Either is CAT III aircraft	6,000 feet
Succeeding aircraft is helicopter	Visual separation

Wake Turbulence Separation – Same Runway or Parallel Runway separated by less than 2,500 feet

Any aircraft behind heavy/B757 departing or landing	2 minutes
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Wake Turbulence Separation – Intersection Departures

Small departing behind large	3 minutes
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Arrivals/Landings

One of your primary responsibilities is to appropriately sequence arrivals.

Cleared to Land Phraseology

We're looking at something very similar to takeoff phraseology.

The Formula: WAKE TURBULENCE/ADVISORIES + WIND + CLEARED TO LAND. In some cases, the order can shift around a bit for fluidity or importance.

Continue: When, for whatever reason, you cannot clear an aircraft to land, you will ask the aircraft to continue the approach. *King Air OPT, continue* or *Lifeguard 2HA, continue approach* or *American 200, report AXMUL inbound*.

Wake Turbulence: We won't cover what wake turbulence is; that information is in the general training syllabus. We will, however, cover how to issue a wake turbulence advisory. CAUTION WAKE TURBULENCE + AIRCRAFT. *United 1512, Caution wake turbulence from the heavy 767 3 mile final for the parallel* or *Skywest 6387, Caution wake turbulence, preceded by a heavy 747 four mile final* or *United 1435, caution wake turbulence from the heavy jet departing prior to your arrival.*

Jet Blast: Jet blast is not the same as wake turbulence. Ask your mentor or instructor to clarify the difference. *Skywest 6229, caution jet blast from the heavy jet holding between the approach ends.*

Do Not Overtake: Under certain circumstances, aircraft on close parallel visual approaches have certain wake turbulence restrictions—for example, a 777 should not be allowed to pass a parallel Brasilia. Ask your mentor or instructor for details on this provision. *United 830 heavy, do not overtake the Brasilia 2 mile final for the parallel.*

Hurry Up: Sometimes you need an airplane to hurry up in the approach. Let's use the overtaking example from the previous paragraph. Say you have a Brasilia for runway 28L and a 777 for 28R that cannot overtake the Brasilia. Say something like *Skywest 6212, traffic a heavy 777 3 in trail for the parallel that cannot overtake you or he'll have to go around, maintain 160 knots or greater to a 3 mile final* or *Skywest 6212, maintain best forward speed for heavy traffic behind.* Another unrelated example: *Eagle Flight 107, keep your speed up, number two is a 757 indicating 50 knots faster.* You can also ask the aircraft to maintain a specific speed until a specific point in space or time, as is shown above.

Slow it Down: Maybe you want to get a departure off the 1s before this aircraft lands. *American 208, slow to final approach speed* or *Horizon Air 2525, start slowing for a northbound departure.* Again, you can assign certain speeds to certain points.

People Leaving: Sometimes you should inform an approaching aircraft of a departure that will occur prior to their arrival. *Frontier 1914, traffic departing midfield prior to your arrival, a Challenger* or *Eagle Flight 104, traffic in position, an RJ* [regional jet].

Change Runways: If you must have an aircraft change from 28L to 28R or 28R to 28L, first make sure that there is ample room for the aircraft to safely and comfortably do so (it's prudent to ask: *United 512, are you able to accept runway 28R?*). The phraseology is: *United 512, change to, cleared to land runway 28R* or *United 512, change to runway 28R, runway 28R, cleared to land.* If you want the aircraft to change a specific point: *United 512, over the bridge, change to, cleared to land runway 28L.* NOTE: "The Bridge" always refers to the San Mateo bridge, not the Dumbarton, not the Bay, not the golden gate. Note that commercial aircraft will often appreciate a change to 28L because it saves taxi time by eliminating the need to cross 28L.

So a full blown landing clearance might sound something like this: *United 830 heavy, San Francisco Tower, caution wake turbulence from the heavy jet three miles ahead for the parallel, wind 280 at 4, runway 28R, cleared to land, reduce to final approach speed, preceded by a King Air 3 mile final indicating 60 knots slower.* That's about as complex as it gets. However, when there aren't conflicts and issues, it can be as simple as *United 830 heavy, San Francisco Tower, runway 28R, cleared for land.*

Getting off the Runway

Once the aircraft has landed, you'll need to tell it how to clear the runway. Most traffic at SFO will exit to the left to the commercial ramps. General aviation traffic, however, should exit to the right for the Signature or GA ramp. Once the aircraft is on its landing rollout, wait until it is slow enough for the pilot to be able to handle radio communications (40-50 kts), then issue an exit instruction.

You can either (i) Use a specific taxiway: *Turn left taxiway Kilo* or *Turn left next taxiway* or *Turn left at the end*, or (ii) Specify a direction: *Turn left when able* or *Turn right when able.* If you're in a hurry to get the aircraft off the runway, say *Skywest 6333, exit on Kilo without delay, traffic on a one and a half mile final and fast.*

If the aircraft needs to cross a runway, it's your job to get him across. For example, a United jet landing on 28R must be issued the instruction to cross 28L. First, however, you need to be sure that no traffic is departing or landing on 28L. So you have two options: *United 830 heavy, turn left taxiway Kilo, cross 28L* or *United 830 heavy, turn left taxiway Kilo, hold short runway 28L, landing traffic*. If you want United to cross, but quickly, say *United 830 heavy, turn left taxiway Kilo, cross 28L without delay, traffic inside a 2 mile final*.

SFO has several "highspeed" taxiways. These are taxiways that are at narrow angles to the runways, so aircraft may turn onto them at higher speeds. For 28R, these taxiways are Tango and Quebec. For 28L, these taxiways are Juliet and Tango. *United 1412, turn left the highspeed Juliet, contact ground point eight*. NOTE: When the first three digits of the ground frequency are 121, you may say "ground point" and then the next number(s).

If ground control is online, tell the aircraft to contact ground. *Skywest 6387, on Kilo cross runway 28L, contact ground point eight*. If ground control is not online, issue the taxi instruction with the exit instruction: *Skywest 6387, use Echo, cross runway 28R, taxi via Alpha to the ramp*. It's also your responsibility to make sure that 6387 and other aircraft do not conflict on the taxi route.

A Note on Phraseology

The examples highlighted in this entire syllabus often represent perfect, professional, realistic phraseology. It's not just new students, but old senior controllers who don't often use phraseology like it is above. You don't need to memorize how to say it like it's presented here—you need to know what to say and when to say it. The most important thing to do is to get your message across.

Radar

Below are some examples of phraseology that make use of radar identification. ZOA has developed a tower radar use SOP. For all intents and purposes, do NOT use radar at towers as a tower student until you and a mentor or instructor have discussed it, and, if necessary, you have passed the appropriate oral or written examination to use radar procedures. Approach and above-rated controllers, talk to a staff member.

Traffic Advisories

An air traffic controller's primary responsibility is to provide separation between the aircraft in his or her airspace. Here, you will learn protocol for providing traffic advisories. NOTE: You should be familiar with radar procedures and proper IFR/VFR separation minimums (Approach syllabus).

Formula

TRAFFIC + RELATIVE POSITION + RELATIVE DISTANCE + ALTITUDE + TYPE + ACTIVITY

Cessna 57V, departing traffic 1 moving to 12 o'clock, 3 miles, climbing through 400, a heavy 767, report it in sight. (57V has the traffic in sight). *Cessna 57V, maintain visual separation, VFR at or below 1,000, caution wake turbulence*.

United 72 heavy, traffic 10 moving to 11 o'clock, 3 miles, climbing through 1,100, a VFR Cessna will be restricted below you, has you in sight.

Options

Remember that you're a radar facility and are allowed to use radar procedures. In the aforementioned example, you could assign a heading to the Cessna and then return the Cessna to its prior course after the 767 traffic is no factor.

Read more about traffic advisories and actions in the Approach syllabus.

Transitions

On Local control, you will occasionally deal with VFR airspace transitions. Here we will discuss proper procedures. NOTE: You should be familiar with radar procedures (Approach syllabus).

Northbound Transitions

Northbound transitions are received from SQL_TWR on a discrete beacon code with instructions to maintain VFR at or above 1,200. These aircraft are told to contact you abeam the runway 12 numbers at SQL. You should radar identify and clear these aircraft into the Bravo airspace at a standard transition altitude or a special altitude depending on jet traffic. Use the following phraseology:

Skylane 60622, ident, cleared into the Bravo airspace, maintain VFR at or below 1,500, remain south and west of Highway 101, San Francisco altimeter 30.18, radar contact 2 miles northwest San Carlos, say altitude.

You may substitute the altitude to anywhere to 2,000 feet, including giving at-or-above or solid altitude restrictions. You may say “keep highway 101 off your right side” instead of saying “south and west” if the pilot is confused. You may use “Bayshore freeway” in lieu of “Highway 101.”

If the pilot is unfamiliar with or cannot locate the freeway, assign a corresponding heading.

Once you have radar identified the aircraft, start a radar track on it.

Over the course of the transition, notify the aircraft of traffic and provide other advisories as necessary. If necessary for traffic (such as the transition aircraft conflicting with the westbound departure course), issue a midfield crossing using this phraseology:

Skylane 622, turn right, cross midfield overhead, reintercept Highway 101 north of the field.

Once the aircraft approaches the lateral limits of your airspace, perform a radar handoff, and tell the aircraft to contact the appropriate Norcal or Oakland Center sector.

Southbound/Westbound Transitions

Southbound transitions are received from STS_APP or CCR_APP radar identified, cleared into the Bravo airspace, and on a discrete beacon code with instructions to maintain VFR at or below 2,000. These aircraft are told to contact you at the north/northeast boundary of your airspace. You do not need to clear them into the Bravo airspace again, but you can if you like just to confirm, and you should notify them that the transition is approved and assign direction or altitude restrictions. Use the following phraseology:

Skylane 60622, transition approved, maintain VFR at or below 2,000, remain south and west of Highway 101, altimeter 30.18.

You may substitute the altitude to anywhere to 2,000 feet, including giving at-or-above or solid altitude restrictions. You may say “keep highway 101 off your left side” instead of saying “south and west” if the pilot is confused. You may use “Bayshore freeway” in lieu of “Highway 101.”

If the pilot is unfamiliar with or cannot locate the freeway, assign a corresponding heading.

Over the course of the transition, notify the aircraft of traffic and provide other advisories as necessary.

Once the aircraft approaches the lateral limits of your airspace, drop track of the aircraft and tell it to contact SQL_TWR on its present beacon code using this phraseology:

Skylane 622, leaving Bravo airspace in 2 miles, radar service terminated, remain on your present beacon code and contact San Carlos Tower 119.0

If the transition is westbound (such as going to HAF), do everything as written above in this section, except instead of handing the aircraft off to SQL_TWR, terminate radar services and tell the aircraft frequency change approved using this phraseology:

Skylane 622, leaving Bravo airspace in 2 miles, radar service terminated, squawk VFR, frequency change approved.

And that's all, folks...

Well, you've just read a fourteen page guide on how to control proficiently at SFO_TWR. I leave you asking you to keep a few things in mind:

(i) If you want to integrate things you've learned or read in this guide during your controlling, don't keep this guide as a reference, copy and paste what you want into your own reference sheet. When you want to find something quickly, browsing through fifteen pages isn't the best way to do it. We've tried to make it easier for you by putting all phraseology examples in blue.

(ii) This is a SFO_TWR guide, but who's to say you can't take the principles presented here and apply them in other positions? Don't take anything word for word and use it at another position, though. For example, mentors don't like to see students who say "Cleared into Class Charlie airspace." ;-)

(iii) This is not a substitute for reading the ZOA general syllabus and it is not a substitute for reading the SOPs. New student or senior controller, you must be familiar with both of these. Like we said at the beginning, this guide doesn't cover what you should have read in other places.

(iv) We provide specific examples of phraseology and specific procedures to follow. Well, air traffic control is a dynamic science, and you can't always go by the book. Adapt to the specific conditions of the time of your controlling and use procedures that make the traffic flow best, and make it flow safely.

(v) SFO_TWR can handle extreme amounts of traffic, so don't expect to be able to master everything immediately! Be patient with your training, mentors, and instructors. We can all tell you from personal experience that patience is indeed a virtue.

“The best part of air traffic control is that you can be as creative as you want. If you have problem aircraft, tell it to go out fifteen miles and fly around in circles. If you have something that won't work, get rid of it. The worst part of air traffic control is that you can never run out of options. You can't just say, ‘Sorry, I don't know what to do, so just crash.’ The worst part is, you can never give up.”

–Former Oakland Center controller, current Palo Alto Tower controller.

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