DATUMS

The next topic we'll be discussing is datums. The purpose of this portion of the lesson is not to try and make everybody out there experts in datums because it's a difficult concept to, to really grasp but the hope is by explaining a little bit about datums we can avoid a user error that often occurs with GPS technology. It's important to know each map that you'll see has a different datum associated with it and that's something that you'll see on the bottom of any map that you pick up. It willl tell you which datum that map is. If you're using your GPS alongside of a map it's important to make sure that the map datum matches your GPS datum. Another important thing about datums is to make sure that when you're communicating a coordinate that you've taken off of your GPS that you can tell which datum it's in and the hope is to explain why that's important by giving you some background information about datums.

Because there are different datums, different ways that the surface, the round surface of the earth is projected onto a flat map there are different coordinates that may look exactly the same. A latitude and a longitude for the exact same spot will be different in a NAD27 Con US datum as opposed to a NAD83 datum. Switching from one datum to another is often called a datum shift because it ends up shifting the location of the point that you're trying to represent on a map off, and here in Arizona that shift can be as much as 300 feet. This I think is one of the best ways to display how datums work and how a feature's coordinate

system will change as the datums change. So, down here at the bottom you can see that in this NAD83 origin the location of this point, say a fire hydrant is 5 degrees east, 1, 2, 3, 4, 5 and 5 degrees north, but just like in the real datums the NAD 27 origin is in a different spot. So while that fire hydrant hasn't moved, hasn't changed, its location would be expressed differently. Here it would be 4.4 degrees east and 7 degrees north. The location hasn't changed and we're reporting it the same way, but the numbers are different. So I always kind of refer to this as a potential for a watch-out situation where you can give a coordinate and if you don't include the datum when you're giving a coordinate either verbally or in writing you have the opportunity to dilute or add air into that coordinate by as much as 300 feet.

Yeah, Aaron, I think this is a real great slide here because you can see how the same feature, which hasn't moved how its coordinates are expressed differently depending on which reference frame you're looking at it in. When we started on, on the, on the green graph paper as I like to call it that, that feature had one set of coordinates. We change to the red graph paper, the NAD27 graph paper, the feature was still in the same spot but it had a different set of coordinates.

So let's look at a more real world example of, of how this can affect you. Here in this picture we see that a helispot with the coordinates in NAD27 puts this spot right here on this map, but with the exact same coordinates in NAD83 it puts it on the other side of the river, moving that particular spot 209 meters. I had a

personal experience with this where we sent some firefighters out to do structure protection on a structure. The coordinates were in a different datum than the firefighters thought they were in, and so we sent them to the wrong side of the Snake River to do a structure protection. After hiking in for a good long ways they could not find any structures there and hiked back out. We ended up wasting some time and causing those guys to do a lot of hiking when the very next day we sent them out to do structure protection on the exact same structure and they drove right up to it. The thing we wanna get across is that coordinate systems, whether they are latitude and longitude or UTM, are ambiguous unless you know what the datum is; we'll talk about this and try and reinforce this lesson later on when we get into some of the button-pushing exercises of the GPS. I wanna mention that, that there are 3 datums that you are going be most concerned with and there're settings in your GPS that you're gonna have to change depending on which map you're using along with your GPS or what other people who you're trying to communicate those coordinates to might be using. The 3 most common datums that you'll be using are NAD27 Con US, NAD83, and WGS84. You should be aware of those 3 datums and know that not reporting a datum along with the coordinate system, either verbally or in writing makes that coordinate system at least a little bit fuzzy when it comes to actually knowing for sure where the location is on the map.

That concludes our lesson on coordinate systems and datums. Let's go ahead and review what we've learned so far.

CONCLUSION

In conclusion, we tried to provide some background knowledge regarding Global Positioning Systems or GPS that will facilitate your understanding and use of GPS receivers. In summary, we tried to cover five key topics.

We began by describing how GPS works. The GPS system is composed of three components: The space component that broadcasts the GPS signals to your GPS receiver; the control component that monitors, analyzes and adjusts the functions of those GPS satellites, and the user component, the men and women on the ground using GPS in their everyday work. We described how GPS receivers calculate the distance to each satellite and uses the intersection of those lines of positions to come up with GPS positions.

We also talked about some of the factors that effect GPS accuracy, including those segments that can be corrected with a differential correction such as WAAS, and the errors associated with stuff that can't be corrected, including multi-source, electromagnetic fields, and user error. We also talked about WAAS and what it was and is, and how it can be used to increase the accuracy of the data that you're gathering with your GPS receiver.

In the section on Coordinate Systems, we described the latitude and longitude coordinate system and how that really works well for positioning and navigation on a spherical planet. We went on to describe the UTM and the State Plane Coordinate Systems that are much more useful when transferring those spherical coordinates onto a flat map that we use in our everyday work.

Remember, with coordinate systems the format matters. We also talked about datums and how a datum shift can affect your coordinates, and tried to impress the idea that coordinates without a datum are ambiguous and not exact. Your GPS unit will automatically convert any coordinate system or any datum into any other coordinate system or datum for you. Hopefully, with a strong foundation and background in Global Positioning Systems you are ready to take out your GPS unit and start pressing some buttons in the demonstrations that follow. So let's get started with receiver setup.