How Did Scientists Improve the Aquarius Satellite Signal? Transcription

So let me stop and just explain to you what one of our key science objectives was in designing Aquarius. After many discussions with the scientific community we were trying to come up with a measuring requirement in order to meet the needs of the scientific users, the scientist out there that wanted to do research, but was also attainable with the engineering capabilities we have.

As I said to you earlier, salinity is measured in parts per thousand. We decided that we needed to have an accuracy of 0.2 parts per thousand of practical salinity units. That’s two parts in ten thousand. So that’s a very small change in salinity that we have to be able to measure. In addition to all of this calibration and stability, and correcting for ocean roughness and the sun, and RFI, and all these other things, we still knew that we were going to have some random errors in the data.

The only way to reduce those random errors is to average over a certain number of samples. The more you average the more you reduce the error of the average value. The way we had to do that is to have enough samples to adequately sample the surface of the earth in order to get enough samples to average it out. That was incorporated into our design of the orbit.

I think if you open up this one we got some pictures in there. Again you saw a video earlier of Aquarius sampling the globe. We designed the mission to—you can see the 3 stripes here representing the 3 beams—over the course of seven days to completely cover the globe with those 3 beams. Each swath is about 400 km. wide and over the course of 7 days we basically cover the whole globe.

This allows us to get four completely independent measurements in a month of time. Actually because the satellite is flying from south to north on one half of its orbit and north to south on the other half of its orbit, we can make two independent maps in 7 days—one from the northbound orbits, and one from the southbound orbits. Effectively we get eight independent measurements of the whole globe over a monthly time period. That was a very important factor in the design of the instrument and the choice of the orbits in order to get enough independent samples so when we average them together we can meet our requirement of monthly accuracy.

This is an interesting image if you could just freeze on this for a second. Can you stop it from spinning? If you remember I said earlier that the range of ocean salinity is about from 32 to 37. You’ll see in the North Atlantic Ocean the brightest red colors, so those are the highest salinities in the open ocean. You see also in the tropical Pacific Ocean the colors are blue, that’s the lower salinities; there’s more rainfall there. There’s a lot less rainfall over the North Atlantic where the high salinities are.

The data that Aquarius collected in the very beginning of the mission after we turned it on already could show us these basic patterns of the distribution of ocean salinity. We knew even then we were on the right track. There a lot of trade-offs that we had to take into account in terms of the width of the swath, the size of the components, the size of the footprints, the shape of the orbit; all of these things had to be carefully factored in order to get both the spatial coverage and the accurate sampling that we needed.