Ocean Gazing
Episode 5: John Orcutt & Frank Vernon

<begin music>

Ari: It's the Ocean Gazing podcast. My name's Ari Daniel Shapiro.

Orcutt: I'm John Orcutt and I'm project director for the cyber-infrastructure component of the ocean observatories and Frank Vernon is the deputy director, and does most of the work.

Vernon: I want his job. <laughs>

Ari: Today, John Orcutt and Frank Vernon – from Scripps Institution of Oceanography and UC San Diego – will explain how they get automated underwater observations back ashore to actual human beings. The sonic stumper awaits as well! Stay tuned.

<fade up music; music ends>

Ari: Over the last few weeks, we've been talking to a bunch of scientists.

Delaney: Hello? My name is John Delaney and…

Sosik: I'm Heidi Sosik…

Olson: And I'm Rob Olson. I'm also a scientist…

Martens: My name is Chris Martens..

Benoit-Bird: I'm Kelly Benoit-Bird. I'm in the College of…

Ari: They've all shared the science they do – or dream about doing – using ocean observatories. Observatories take measurements in the ocean autonomously – that is, without the need of a human being. But there's still the problem of getting all those data back to the researchers on land. The answer, explains Orcutt, is something called cyber-infrastructure.

Orcutt: Coined basically to describe all the technologies and the software and middleware that go into building modern computing systems and network systems.

Ari: The idea is not for scientists to hold onto their data until they get it published. Rather, cyber-infrastructure's about using the Internet to share information collected in the ocean.

Orcutt: Yeah, we really are trying to democratize access to data.

Ari: Vernon agrees.

Vernon: We hope that everybody takes advantage of it – there'd be people from the K through 12, policy makers, it'll be research scientists, graduate students – I don't think there's any limit or bound.

Orcutt: We're not restricting the access of anyone to data – it can be used nationally and internationally. So this is a pretty unique approach to dealing with earth data, something that simply doesn't exist today. So changing the system to an open system where the data are immediately available to everyone to use is a vast cultural change in science.

Ari: The job's not easy though. This stuff can get kinda technical.

<medley: the following cuts go back and forth very quickly; Orcutt and Vernon talk constantly throughout>

Vernon: Getting a ubiquitous –

Orcutt: – fiber optic cable –

Vernon: – measurement through the whole ocean environment –

Orcutt: – at least 10 gigabits per second –

Vernon: – 800 pound gorilla in this system –

Orcutt: – called the National LambdaRail –

Vernon: – new types and new generations of sensors –

Orcutt: – building new networks that were telemetered by wireless –

Vernon: – that's cyber-infrastructure for you. Hate to tell you. <laughs>

<end medley>

Ari: But the punch line's pretty straightforward.

Vernon: One of the core things that we're trying to do is link together whole sets of technologies that have never been connected together in one system before, but all of 'em exist and are well-developed in their own right.

Ari: Everything about this initiative is big, including the challenges. The system has to endure for centuries for observations of trends in the ocean and climate to mean anything.

And the amounts of data are staggering. Take a high definition video feed, say, from the bottom of the ocean. You have to count the data from that video not in megabytes or gigabytes, but in terabytes.

Vernon: Put that into perspective: how 'bout a million million?

Orcutt: It's a lot of data. If you took all the books in the Library of Congress, it all fits within a few terabytes of storage.

Ari: And then you have to get the data outta the ocean and back ashore. There're a couple ways of doing this.

Orcutt: One of 'em is cabled observatories. These are commercial communications cables that will be laid on the seafloor. The fibers which carry all the information are a little bit bigger than a human hair so they don't amount to much, but they have to be armored and included with copper to carry power to run all these different instruments. And then has to be armored so the cable itself doesn't break or get attacked by something like a trawler. So the cable itself can be a couple of inches in diameter even though the stuff we're using inside is really fairly small. The other approach is of course satellite communications – we use our ships and antennae on the ships to carry information back and forth half a world away. And we'll be doing the same thing with autonomous vehicles that are operating half a world away as well.

Ari: This information then gets funneled into the Internet so people all over the world can use it openly and in real time.

Orcutt: It will also be available for anyone to subscribe to a datastream, much as you'd go to iTunes and sign up for a podcast –

Ari: Like this one!

Orcutt: – you will go to iTunes and sign up for a feed from a particular instrument in another part of the world.

<fade up computer server ambi>

Ari: It takes a lot of computing power to process all of the data. Frank Vernon describes last episode's sonic stumper.

Vernon: This is a server room, which we acquire data from multiple sensor networks deployed in the environment around the world. And what you're hearing is the servers and the discs that are recording all the data.

<fade out computer server ambi>

Ari: Do you get – I'm just curious – do you get nervous, do you get excited, are there butterflies, stage fright, nausea.

Vernon: Yes!

Ari: Or is it not anywhere that dramatic?

Vernon: Oh, there's plenty of drama. There's times when you don't know when things are gonna work. There's times you find you can see impending disaster. And then you have to react and possibly redesign and rebuild and move forward with it.

Ari: There's drama because the data they're gathering can have some high stakes.

Orcutt: You must understand that for things such as disasters like tsunamis and volcanoes and so on, if the data are not immediately available, they're really not very useful for most civil applications. That is, warning the population, moving the population. And today, our biggest worry and concern is what will happen to climate over the coming decades and centuries. And in order to make these data useful to people, they've gotta be open, they've gotta be able to be integrated into models for interpolation and prediction into the future.

Vernon: The National Weather Service has systems like this in place everyday. I mean, you get your forecast, you get your tornado warnings, you get your fire – red flag day alert. This type of thing's being done. What the difference with what we're looking at is instead of putting just the information and knowledge out there, we're actually providing access to the raw data itself.

Ari: And cyber-infrastructure will allow folks not only to use the data now, but it will also provide a way of reaching far into the future.

Orcutt: We need to think about what the Earth will be like a thousand years from now, assuming that we are able to make some changes in the way that we work and behave with regard to the planet we live on and the climate here so that we actually do have a future, and that we'll get there.

<fade up transition music>

Ari: Ready for the sonic stumper?

<fade up sonic stumper>

<fade down under next track and bring up music>

Ari: That's our episode! Come to www.coseenow.net for a visit, and click the podcast link. Once you're there, you can ask John Orcutt and Frank Vernon a question and you can learn about how their work relates to NASA's rovers on Mars!

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Thanks for dropping by! See you online.

<fade music up until the end>