A view ABOVE ALL

News From Ocean Imaging Corporation

Volume 2 Issue 2

Summer 2004

NEW! Low-Carb Remote Sensing!

Another miracle diet, yet the verdict on its long-term benefits is not yet so clear. The situation reminds me of the past decade in remote sensing. Prior to the mid-90s commercial remote sensing (RS) grew steadily but slowly compared to, say, the GIS world. Then, in-tune with the dot-com bubble age, high resolution satellite mania swept many off their feet. Satellite companies and many analysts lauded huge market potentials. Graphs forecasting extreme exponential growth in high-res commercial revenue were a staple in every presentation. Much of the growth was to come from the public: people will buy imagery of their home towns, real-estate agents will purchase images to show property boundaries. Just about everyone was going to benefit from satellite images. As many of us know, those exponential graphs soon wilted. The sales teams realized that many of the anticipated markets do not have staying power. Today, government agencies remain the core business of the commercial satellite giants. Steady growth in the public RS sector is back to just eating smaller meals.

I believe the reason for the overestimated long-term benefits of RS lay in the broad misconception of just how useful the new high-res imagery is. A picture of the U.S. Capitol commonly features in the new satellite data ads. It may point out the sensor's novel resolution, but in the end… it's just a picture. Unless you seek a view of the Saharan Desert or similarly remote place, the same image can be gotten from many regional aerial photo companies for hundreds or thousands of dollars less…at up to 100 times better resolution! At OI we find that many of the yet-dormant public markets are no longer impressed with pictures from

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Fishfinding From Space

Whether you fish for a living or sport, finding your query in the world's vast oceans is no easy task. Throughout history fishermen have looked for clues on the sea surface to help locate spots where fish aggregate. Some fish prefer waters of a certain temperature, for example, so it's a waste of time looking for them in places that are cooler or warmer. Abundance of food also attracts fish, so large predators like tuna tend to concentrate in areas with plentiful smaller fish. Since the smaller critters feed on plankton, edges of green, plankton-rich waters or "color breaks" tend to be good fishing spots.

Many of the fishfinding indicators used by fishermen can now be detected by satellites. They include ocean temperature, color and currents. Back in the mid-80s NASA made experimental satellite-derived ocean temperature and color charts available to commercial fishing fleets. The information was valued, but since the ocean changes quickly, the 2-3 day lag between data acquisition and when fishermen received the charts limited their usefulness. As the NASA project ended, a fledgling Ocean Imaging was one of the first to commercialize satellite-based "Fish-Finding" services.

In the late 80s the biggest problem was how to get the information to ships at sea. Initially, OI used weatherfax radio transmissions, sending black and white charts with

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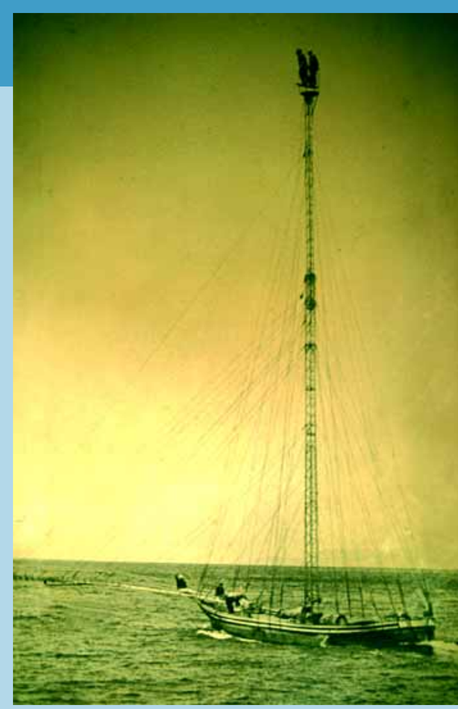

The dawn of remote sesing: some "extreme" fishermen in the 1920's search for signs of fish from above.

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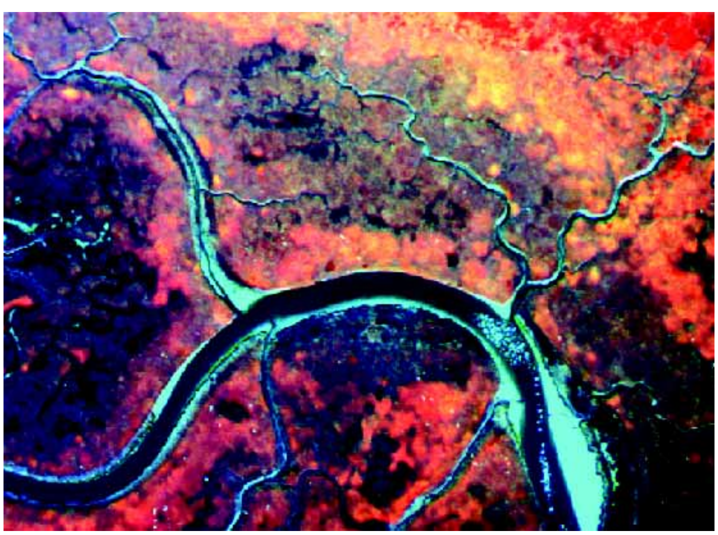
Using GIS to learn from *Mother Nature*

Ocean Imaging has been mapping vegetation in several coastal wetlands in support of upcoming habitat restoration projects. To consider the restoration successful, numerous factors will be monitored. These include the type of vegetation, the amount of non-native, invasive species, and the total area of bare space. To establish a baseline, OI imaged and classified ground cover in the wetland slated for restoration as well as other "control site" wetlands to which the post-restored region will be compared. The classified imagery is combined with other data in a Geographic Information System (GIS) to be used by the various agencies involved in the project.

"Ice plant" is attractive but very invasive in California's coastal wetlands. Originally from South Africa, it was brought to California in the early 1900s for soil stabilization along railroads.

Some past restoration efforts have resulted in unpleasant surprises that, with more experience and the GIS data, will hopefully be avoided in the future. For example, in the San Dieguito Lagoon north of San Diego, dredged soil was deposited in one area many years ago in hopes of establishing new ground for native marsh plants. Yet the area remains bare to this day, most likely because its elevation is too high above the water line for the marsh plants, and too low (and salty) for other types of vegetation. Amazingly, as the GIS data show, the elevation difference is only about a foot.

Another case where Mother Nature had her way was in the Tijuana River Estuary near the U.S./Mexico border. A portion of the marsh was restored and successfully replanted with native vegetation. As part of the project, tidal channels were created, with numerous subchannels fingering out from the main ones. The main channels held, but most of the smaller ones filled with soil over time while others got created in different spots on their own. Since even the restoration experts aren't clear on what Nature considers a good location for the small channels vs. a bad one, a "dendritic" approach will be used in the San Dieguito restoration: build the larger channels and let Nature figure out where the smaller ones should be. OI will continue to image the region periodically and the new features will then be added to the permanent GIS data base.



This image, resembling a microphoto of a human neuron, is actually a DMSC-imaged tidal channel in the Tijuana River Estuary exhibiting "dendritic" structure.

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space - they want information. A fisherman needs water color patterns…today. A farmer wants data processed to show his watering needs…today. An oil spill response team needs the oil signal isolated from "background noise"…today, and again tomorrow.

The general inability for the new high-res satellite operators to provide imagery in near-real-time (at a down-to-earth-price) is one constraint. However, I believe another problem for expanding many yet-dormant markets is the continuing collaboration gap between the research community and the value-added RS industry. A new detection or monitoring capability usually grows out of research and validation. But end-user input is often vital for development of a product he/she will actually want and pay for, and the value-added provider is generally needed to link the two groups. The satellite companies do not presently have the cash and/or incentive to fund this multi-step process, and federally-supported facilitators such as NASA's EOCAP program have

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disappeared before their time. The grant-funded researchers may have the knowledge, the value-adds don't/can't connect, and the end-users get no benefit. With the most recent failure of the Resource-21 project which aimed to bring satellite technology to the potentially huge agricultural market, the commercial value-added field is licking its wounds. There are numerous notable exceptions, of course. But many potential end-users remain locked-out of the RS world. We at OI have tried to keep the research-to-application bridge open. In this issue you will find examples of our efforts to bring useful RS-based information from the research arena to public, operational use. I hope you find the articles interesting. And as always, don't forget us for your remote sensing needs – we're up to a solution!

Sincerely,

Jan Svejkovsky

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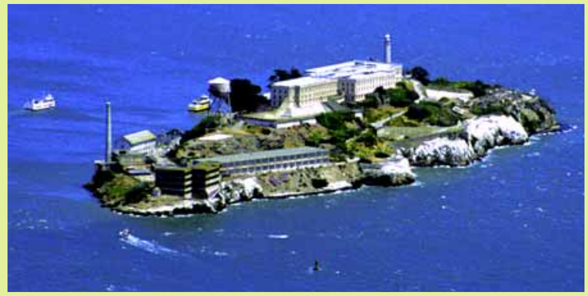
CONTEST: *Where in the* WORLD *are we?*



This notorious island has been home to men that most people would not consider good neighbors. It is near one of OI's recent projects. First 5 people to name the island **and the type of work OI is doing in the area** (clues are in this newsletter) will receive a free Ocean Imaging T-shirt.

E-mail answers to ***kristen@oceani.com*** **(don't forget to state shirt size: M,L or XL).**

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lines outlining the locations of thermal or color breaks. Because the wefax signals could not be legally scrambled, everyone on the ocean received the charts. To protect the investment of our subscribers, OI devised various coding schemes to make it impossible for others to decipher the charts' location or temperatures. Timeliness was also important. The charts were drawn and broadcast within hours of satellite data capture. And they worked. Within a few years nearly every offshore fisherman on the west coast was hooked on the "OceanEye" satellite "dope".

The line charts were good but couldn't depict the detail contained in the satellite imagery. Amazingly, a 0.2º difference between a "hot spot" and surrounding water sometimes meant double the catch. OI's quest to deliver more information to the boats began a decade of ever-changing technological innovations. Our first attempts included dropping photo prints from aircraft, experimental FCC licenses for slow-scan TV and Packet Data Radio, then cell-phone systems with beefed-up antennas. Technology was not always the problem: satellite phones existed long before we got into this. But at $40,000 for equipment and $4-7/minute airtime fees, not many fishermen could afford that set-up.

These days cheap ($1K equipment, $1/min air) sat-phones are the standard way we disseminate our fishfinding products. The product types have also grown: in addition to worldwide water temp and color, we provide multi-day composites (to reduce cloud-cover problems), sea surface height and currents, even image movie loops that let fishermen see how the water patterns are changing in time.

Our "SeaView" fishfinding system working hard aboard a fishing vessel.

All this may make you think that no fish in the ocean stands a chance of not being hunted down and caught. Not quite. The information we provide is akin to a road map, but not all the good-looking places hold fish. For example, fishes like tuna, salmon and marlin are migratory, so it does not matter how good the ocean conditions appear if you are not at the right place at the right time.

Fishfinding services are now only a fraction of OI's business, but some of us veterans nostalgically recall the older days, when the constant hum of the office marine radio provided both a data link and entertainment: "Ocean Eye! This is fishing vessel *Agressor*. I need the latest chart. Oh, and can you place a bet for me on tomorrow's Kentucky Derby?"

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Looking for OIL in all the wrong places

Fuel spill from a dock in San Diego Bay revealed by UV fluorescence.

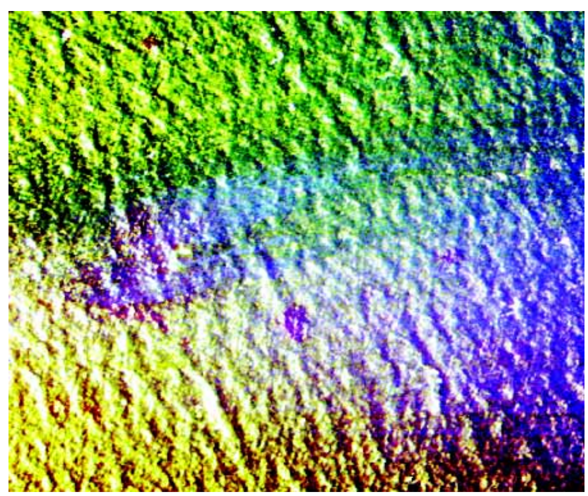
It's not what you think…the OI gang has not turned into a bunch of luckless wildcatters. Instead, we began work on a project supported by California's Office of Oil Spill Prevention and Response (OSPR). The objective is to develop and test effective, yet economical and easy to deploy methodology for detecting oil in places it shouldn't be: tanker spills, pipeline breaks, illegal bilge dumps. We are also devising ways to detect the effects of oil-impacted soils to assess environmental damage after a spill.

Our main instrument is the 4-channel DMSC aerial sensor. Although oil spill detection has been done previously with specialized hyperspectral instruments or laser fluorosensors, their operation in an emergency or for routine surveilance is generally too expensive or impractical. Similarly, Synthetic Aperture Radar (SAR) imaging (which reveals slicks on the ocean surface) is relatively expensive and suffers from the inability to distinguish true oil slicks from false targets like biogenic surface films or low-wind effects. Our approach is to determine through experimentation a 4 wavelength combination spanning the UV-Visible-nearIR spectrum range that will allow, with special processing, detection of oil films with minimal false targets. The same approach will be used to configure the sensor for oil-on-land applications. If successful, the very portable, easy to mobilize system will allow immediate response to an emergency, and cost-effective surveilance. Later in the project we will actually process and disseminate the imagery in-flight over a satellite phone to help guide recovery operations.

Since getting permission to dump various types of petroleum into the sea and on land is near-impossible even for OSPR, we will rely on natural oil seeps and accidental discharges for our experiments. The Santa Barbara Channel is a perfect place to start: plenty of oil rigs (some old ones leak occasionally), and many natural seeps that dribble crude oil to the surface. There are also natural slicks (i.e. "false targets") caused by plankton and kelp. Our initial tests are promising, especially the use of UV wavelengths to detect actual oil within larger surface slick areas.

If you think waiting for oil spill accidents is not a practical way to design experiments, think again. One of our land test targets is a former oil field that has had so many spills, surrounding home owners must sign liability waivers acknowledging their living near the contaminated soil. Our other test site appeared just as the project got started, when a diesel pipeline burst in a marsh near San Francisco, spilling as much as 50,000 gallons into the environmentally sensitive area. We captured several data sets immediately after the spill and will compare them with future images to detect environmental damage. (It has now turned into a fully operational project.)

We've also already documented incidents in the ocean. One was a fuel spill within San Diego Bay, the other an illegal bilge dump (which tends to contain a lot of petroleum waste) from a large ship steaming to port. We hate to think of what our next "test subject" will be.



A "psychededelic" view of a natural oil seep - actually, a DMSC multispectral combination revealing thick oil (purple spots), thinner oil (light blue streaks) and surface sun reflectance(green, white and yellow).

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