



Looking ahead to 2020 in the world of geophysics

Bob Peebler,* CEO, ION Geophysical and well known E&P industry commentator, sees compute power as a major driver for change in the next decade.

Oil companies will continue to push into more difficult frontiers with the realization that new conventional reserves are very difficult to find, and are usually in harsh environments such as deep water, the Arctic, or environmentally sensitive areas that are hard to reach. Unconventional resources, such as oil and gas shales, have also become significant targets for exploitation, and it is expected that this phenomenon will rapidly spread around the world, potentially shifting dramatically the energy strategies of both consuming and producing nations. The shale plays have the potential to be a major discontinuity in the energy market that could change the narrative on solutions to global warming. If new technologies that convert natural gas to gasoline become a commercial reality, we could see a significant market opening up for natural gas powered vehicles that would likely rebalance the price between oil and gas. What is certain is the technical challenges will continue to grow exponentially, and we will likely need every ounce of computing power available, combined with significant advances in geophysics, to solve the problems at hand.

On the computing front, there are several forces at work that will likely make the computing world by 2020

almost unimaginable compared to where we started at the beginning of the new millennium. Underpinning all of this is the never ending drumbeat of ever increasing compute power. About the time the computing industry calls for the inevitable demise of Moore's Law, another advance in technology comes along that allows the trend to continue as it always has been. This time, however, instead of just proving itself consistently correct, Moore's Law is going to have to be completely rewritten. Instead of microprocessor technology doubling its performance every two years, we'll experience 10–20 fold increases in computational power, at a bare minimum, every five years, due to technologies like nanophotonics. We can look forward to a 20x increase in home and office network speeds, with a petabyte (1 million gigabytes) or more of storage costing around \$100, and internet evolving to instantaneous communication regardless of distance. These technologies and more will converge to move cloud computing into the mainstream. PCs as we know them will virtually disappear from the landscape, and workflows will be dramatically impacted by the further integration of field operations with the office and the continued move to virtual teams.



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These computing trends are mainly being driven by the horizontal consumer markets, but as in the past, our industry will take advantage of them to once again enable geophysical technology that is not possible today, both in field acquisition and processing/interpretation. I foresee several trends that will be accelerated due to the continued explosion of computing technology, including the following, which I consider most important:

- Further extending our imaging into the elastic domain (full-wave field), with routine elastic modelling that will result in much improved reservoir characterization, including lithological and even fluid type identification.
- Next generation 'true' 3D interpretation workstations and data management systems that support the data explosion for much higher density shooting and multiple data types such as EM. The lines between processing and interpretation will become more blurred, and rapid iteration for problem solving will become the norm. Interpreting in the depth domain will also become standard practice. Real time processing/interpretation during acquisition to refine data acquisition processes to both optimize operations and improve image quality will become commonplace, particularly in marine operations where capital investment is so high.



Early Firefly cableless land survey operation.

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Geo Explorer on Arctic business for ION Geophysical.

- Integration of surface seismic and microseismic to better optimize the cost of drilling and production. Understanding the pressure within the frac network and how it relates to drainage will be a key technology driver.
- Land fold approaching that of marine due to much higher density receiver and source points, with single point full-wave (3C) receivers becoming mainstream.
- Wireless real time land systems that support high density shooting largely replacing conventional cable systems as capital costs come down to parity, with the productivity of the cableless systems driving significant advantages in operating costs.
- Next generation land sources that will produce much lower and higher frequencies and extremely low distortion, further enabling autonomous shooting.
- Ocean bottom recording, both retrievable cable and node systems, that become much more efficient to the point that they become cost competitive with towed streamer in many development and production areas. This, coupled with much improved

imaging, will move OBC from a costly niche to a mainstream technology in the marine environment.

- A third generation of towed streamer technology featuring 'smart streamers' integrated into steering and positioning devices. Combined with real time computing, they will enable much more efficient operations and better images, with intelligent acquisition adjusting operations in real time, to maximize both operational efficiency and image quality.

I'm sure there will be many more breakthroughs than the ones I've listed, as it's hard to comprehend what the combination of unbelievable computing technology and the brightest minds of our industry will create. It's also difficult to predict exact timing of the diffusion of new technologies, but we can be sure of one thing: 2020 will be dramatically different, and our geophysical industry will continue to be part of the technology lifeblood of our industry.