

Biondo Biondi is receiving the Reginald Fessenden Award for his development of aximuthal moveout (AMO), which does for 3D data what dip moveout did for 2D data. AMO has contributed to many other developments in the areas of migration, multiple attenuation, and regularization of seismic data. The net result of Biondo's efforts has been an accelerated development of high quality seismic imaging, velocity analysis, and AVO analysis methods in 3D. This work received general recognition in 2001 at an SEG session which Biondi helped organize. In honoring Biondo Biondi, SEG is recognizing the important role that seismic imaging plays in exploration geophysics, and a great innovator in the field.



Reginald Fessenden Award for Biondo Biondi

by Jon Claerbout

Early in his career, Biondo understood that 3D seismology was going to have a major impact on oil and gas exploration and that developing successful 3D algorithms would require much more than simply rewriting 2D equations in 3D.

The azimuth moveout (AMO) process, for which he is being honored, is a perfect example of an inherently 3D process (the AMO operator is capable of transforming both the offset and the azimuth of 3D data) that is particularly useful because of the irregular and incomplete nature of 3D acquisition geometries. AMO is flexible and can interpolate and regularize 3D seismic data. Data need to be regularized because wave-propagation numerical algorithms are more comprehensible and more efficient on a regular grid. A widely used application of AMO is regularizing marine data before common-azimuth migration. This imaging sequence delivers accurate and cost-effective images of the subsurface under complex overburden. Its introduction contributed to the shift toward wave-equation migration for subsalt targets.

Since 1993, when he returned to the Stanford Exploration Project (SEP), Biondo has striven to shift SEP research from 2D to 3D. This has led to the development of several algorithms now routinely applied, and to the education of a new generation of seismologists who instinctively look for 3D solutions to seismic imaging problems.

Biondo believes that breakthroughs come only when theoretical ideas are continuously confronted with real 3D data. He therefore began updating SEP's computational infrastructure. SEP needed a powerful computer and had raised the money to buy a Connection Machine 5, the first of a series of parallel computers that turned SEP into a leader of 3D seismology research. An SGI Power Challenge followed and in 1999 we began cluster computing in earnest.

Today, SEP boasts about 250 CPUs in our Linux clusters. However, powerful hardware is insufficient without adequate software. Consequently, Biondo set out to design a 3D processing system tailored for algorithmic development. He and Bob Clapp developed SEP3D, a flexible 3D processing system, based on our earlier 2D system called Seplib, that efficiently tested new imaging algorithms on large (by academic standards) 3D data sets.

Biondo's passion for seismology was triggered while working on his honor thesis under Fabio Rocca at the

Politecnico di Milano, where he got his diploma in electrical engineering and signal processing in 1984. He became enthusiastic about using creative mathematical approximations and clever algorithms to transform the messy seismic data recorded in the field into beautiful, crisp subsurface images.

He subsequently became one of my students at Stanford, where he got his MS (1988) and PhD (1990) in geophysics. Biondo realized that parallel computers would revolutionize our profession. To learn more about this transforming technology, he joined Thinking Machines, a pioneer in parallel computing. He rejoined SEP as a consulting faculty member in 1993, became associate professor (research) of geophysics in 1999, and SEP codirector in 2000.

Biondo's interest in seismic imaging goes beyond new algorithms. He is not fully satisfied unless he sees the algorithm applied to real world problems. To fulfill these practical aspirations, in 1994 he cofounded 3DGeo Development. His ongoing collaboration with 3DGeo provides first-hand experience of the challenges that industry faces when processing large amounts of real data. Thanks to the lessons that Biondo learns through this practical side of his activities, SEP is less in danger of being isolated in the ivory tower of academia.

To share the wealth of knowledge on 3D seismic imaging algorithms accumulated in the past several years, Biondo is working on a textbook *3D Seismic Imaging* which will be published by SEG. This is the first book to introduce the theory of seismic imaging from a 3D perspective. It provides an up-to-date and coherent overview of recent progress in 3D wave-equation prestack imaging, many directly achieved, or inspired, by his and his students' work.

Biondo and his students are continuing to advance the state-of-the-art in seismic imaging of complex structure. Particularly promising are recent developments in estimating an accurate velocity function. Biondo and his students have developed methods for extracting velocity information from the results of wave-equation migration and convert this information into velocity updates. Furthermore, they have developed a practical method to use a wave-equation operator to update the velocity. We can thus expect other papers and books that will enrich our knowledge.

