Introduction to MOSRP03

This has been a positive year for M-OSRP with significant progress on all projects. Noteworthy advances were reported on the two closely interrelated subprograms: (1) developing fundamental new effective capability to locate and delineate targets with both complex or simple reflector geometry without assumptions about the size of contrasts in properties and, furthermore, to achieve those objectives when the overburden cannot be adequately determined to allow current imaging-inversion methods to be effective; and, (2) developing methods to provide the necessary completeness of data collected and definition required by these non-linear sub-series: (i) data extrapolation and interpolation, (ii) source signature estimation and (iii) deghosting.

Among the highlights are:

(1) a method was developed and tested providing a robust new wavelet estimation method only requiring pressure measurements along the towed streamer, Z. Guo;

(2) a procedure was derived that provides deghosted towed streamer data from pressure measurements, with tests showing encouraging results, J. Zhang;

(3) a data reconstruction procedure that seeks maximum fidelity was analyzed and evaluated for primaries and multiples, for use with subsequent free-surface multiple attenuation, F. Miranda;

(4) the careful analysis, testing and evaluation of the 1D prestack leading order imaging series showed encouraging and reasonable effectiveness with absence of low vertical wave number information, passing a critical practical test, S. Shaw;

(5) following the 1D prestack results of Simon Shaw, Fang Liu developed and tested a 2D inverse series for a laterally and vertically varying subsurface, and first tests demonstrate moving the image of the target towards accurate spatial location with an input constant and unchanged velocity. This test was completed on our new IBM Blade Server, F. Liu;

(6) good progress and careful analysis for the modelling and inversion of headwaves for inclusion in imaging and as an internal multiple subevent, thereby expanding the class of events removed as internal multiples, B. Nita;

(7) extension of multi-parameter acoustic non-linear direct inversion to multi-parameter elastic inversion unambiguously defines the PP, PS, SP and SS data as minimum required

for that step beyond linear, and progress in analysis aimed at choosing elastic parameters to facilitate task separated interpretation and subseries for reflector location and parameter estimation in the elastic earth, H. Zhang;

(8) Kris Innanen brings us a step towards further realism of the subsurface model by including absorption in the forward and inverse series developing linear and non-linear series terms, coupled task subseries, and progress towards the ultimate objective of adding the task of achieving accurate Q compensation directly in terms of an inadequate Q estimate through non-linear communication between different events in the recorded data.

A five month SEG DL tour, provided an opportunity for me to visit and communicate with petroleum geophysicists around the world. That communication encouraged M-OSRP to consider returning to, and further pursuing, our earlier research in the area of multiples. Several actions followed:

(1) a M-OSRP Forum on Multiples was held at UH on Nov. 14, 2003 with attendees from 25 companies. Bill Dragoset, Ken Matson and I gave presentations on the Industry Status, Open Issues and Plans and DVD of the talks were distributed to sponsors.

(2) Progress on a SEG reprint volume on Multiple Attenuation, co edited by Bill Dragoset and myself, allowed an opportunity to provide a new perspective on the extensive literature on that subject; a preview of the soon-to-be-completed chapter introductions is provided in this report.

(3) A decision to expand M-OSRP into the area of multiples starting in 2004, with a team directed by Kris Innanen, and consulting by Dennis Corrigan and guidance from Adjunct Professor Ken Matson, of BP, moving M-OSRP into further analysis and an extension of inverse scattering internal multiple concepts. Activities will include the production and testing of algorithms and research prototype codes for 2D and then 3D marine towed-streamer data. The research of Bogdan Nita will interface and impact the analysis of expanded internal multiple efficacy. The plan is to add two Ph.D. graduate students to this project during the Spring 2004 semester. The delivery of M-OSRP extrapolation/interpolation methods will be coordinated with corresponding internal multiple codes.

A warm welcome to new Ph.D. graduate students Adriana Citlali and Sameera Rajapakshe. Einar Otnes, 2004 Statoil Fellow, is pursuing his Ph.D. with Bjorn Ursin at the Norwegian University of Science and Technology, Trondheim, and spending 2004 with M-OSRP. Einar is a creative, productive and capable young scientist and positive influence on our entire team. A very warm welcome to Brian Schlottmann, from Princeton University, the Amerada Hess Postdoctoral Fellow. Brian energetically launched into a research project on the analysis of diving waves and imaging and internal multiple subevents. Thanks to ConocoPhillips for graduate fellowships to Simon Shaw, Haiyan Zhang and Fang Liu. The contributions of our Adjunct Professors: Doug Foster, Bob Keys, Jacques Leveille, Ken Matson, Jon Sheiman, Bob Stolt, Hing Tan and Dan Whitmore to the guidance and mentoring of our students is gratefully acknowledged.

In summary, the 2003 progress to report is positive and significant, both in terms of critical robustness evaluation and extension of fundamentally new imaging and inversion capability, and also in the critically important practical prerequisites required to allow these new concepts to reach their potential. The planned M-OSRP growth into new practical and effective demultiple methods, dovetails with and serves the central thrust of our program for a fundamentally new vision and capability for processing primaries and multiples.

Arthur B. Weglein

University of Houston
March 24, 2004.