Justifying Broadband Seismic Acquisition

B. Barley* (Reliance-BP JV) & G. Akula (Reliance-BP JV)

One of the future trends in ‘broadband’ must be to reconcile the visionary with the practical:

- The geological significance of seismic data is easier to *communicate* using layer based impedance than it is using interface reflectivity, but many interpreters distrust the additional steps required to derive impedance from reflectivity.
- Many interpretation workflows involve *mapping interfaces quickly*, and this has created a thriving market for reflectivity (not impedance) volumes and bandwidths optimized to detect interfaces of interest.

When interpreters say that they dislike ‘broadband’ reflectivity (as some of them do) it is missing the point to reply that, in principle, enhanced low frequencies feed through into improved impedance products. The reconciliation requires us to show that the improved bandwidth can be exploited practically and reliably in large data volumes using accessible workflows.

This paper illustrates how broadband acquisition was justified for the appraisal and development of a recent RIL-BP discovery off the East Coast of India. Elastic impedance products (Connolly 1999, Whitcombe et al 2002) derived from well logs are modeled using the current usable bandwidth vs various realistic increases in bandwidth. Because these are layer based descriptions of the subsurface, it is easier to communicate their upside to a general audience of geologists and engineers and budget holders. And because these products depend only on the seismic bandwidth (not on models) and are in use in specific, practical interpretation workflows today (eg coloured inversion (Lancaster and Whitcombe 2000) and Seismic Net Pay estimation (Connolly 2007)), it is easier to argue that the benefits can quickly and reliably be harvested.

We are over the hurdle of benefits-in-principle but the field of technical practice on the other side is much heavier going. Broadband acquisition and processing methods continue to diversify and the quality vs cost equation is far from clear, as anyone who has tried to write a competitive broadband tender will tell you.

Even the most cautious sales staff will promise improved S/N at a broad range of frequencies in the recorded data because that is in the engineering. However, the details of how to ensure usable phase stability at 2-5Hz and how to preserve signal and control noise in the final processed products are harder to come by, partly because they are trade secrets and maybe also because they are less well understood. This is especially true for specialized products such as elastic impedance, which are unusually sensitive to noise in the gradient of reflectivity amplitude vs offset. Is it reasonable to expect that we can process to the required standard, and how will we know that new acquisition was justified?

The second half of the paper compares elastic impedance products based on legacy processing with results using inhouse methods, which improve the S/N in gradient data at low and high frequencies. Wellties are used to establish the usable bandwidth and provide a benchmark to be beaten by successful new acquisition and processing.