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The next battlefield

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Over the years, I bore witness to the degradation of many a type of storage media used in the oil and gas industry. Storage media once thought totally reliable are now becoming the bane of our existence, and should be significant sources of concern for our data collections.

Someone once not so famously said, that the best recording media for data, hands down, is microfilm – with this I agree. All you need to recover data from microfilm is a magnifying glass and a flashlight. No fancy electronic devices or magnetic decoding required. However, the reality being we chose to use magnetic tapes, hard disks, memory sticks and a range of other devices, far more technical than microfilm, to store the vast majority of our information. So now, we must deal with the consequences.

From 1960 to present day, there has been a variety of media types created and mass-produced: some of them stood the test of time, whilst many others fell to the wayside almost immediately after their release into the market. The following generalised technology timeline, outlining the uptake of different types of storage media specific to the oil and gas industry over time, reveals our predicament:

- 1950s to 1970s – we used 9-Track Reel-to-Reel Tape
- 1970s to 1980s – a sign of relief ensued as we moved into 3480 closed cartridges.
- 1980s to 1990s – we moved from 3480 to 3490, DLT, 8 mm and 4 mm data cartridges
- 1990s to 2000 – the 8 mm, 4 mm and 3490 technology dropped in popularity as we moved to 3590 and LTO began
- 2000 to present day – we see various LTO types and 3592 as our mainstay

There were also some other odd media types in here like Sony AIT, Travan and DEC, which had brief bouts of traction, but did not really become part of the mainstay of the industry (in many ways, we should be thankful).

There are a number of standout technologies: some for the right reasons and others for the wrong reasons. Let us start with the positives and look at technologies that are in good stead even after many years of use and storage:

1. Almost all IBM engineered cartridge media types (3480, 3490, 3590 and 3592) are excellent. The 3480 is still readable after 30 years and showing very little signs of deterioration.
2. LTO technologies are seemingly performing well. Although, the sheer number of different manufacturers of this media and drive technology means that someone will figure out a way to screw things up. It will be another five to ten years before we really know how this media holds up.

On the negative front, we see the following:

1. Floppy disk technology: One look at a floppy disk today and you know it will be trouble. Funnily enough, back in the 80s they looked pretty damn cool. Given computers are no longer fitted with a floppy reader anymore, it is time to get the data off these disks or consider it lost forever.
2. 4 mm and 8 mm Data Cartridges: This consumer grade technology found its way into the oil and gas industry: the 4 mm data cartridge became heavily embedded into the well logging area; whereas the 8 mm data cartridge, ended up being a great transport media for processed seismic. The high tension placed by a drive on media of such narrow width, meant trouble from the start. Add in the fact that the tape drive heads that write this data do so using Helical Scan technology (basically, 100 more moving parts than necessary). In all, recovery of damaged or deteriorated data cartridges is becoming nearly impossible.
3. 7-, 9-, 14- and 21-track reel-to-reel tapes: Yes, the ones featured in the old James Bond movies in Q's office where he built all of the cool gadgets. Interestingly, the manufacturer of the tape media itself most heavily influences the recoverability of this media type. Some manufacturers put a lot of time and energy into the creation of the media; others cut corners and came out with budget brands. The budget brands simply did not stand the test of time. I can take one look at a brand of media and tell you if the data will be recoverable or not. In almost all occasions, the best tape brand, stored in the worst possible conditions, is better than the worst tape brand, stored in the best possible storage conditions.

In Australia, the 9-track tape is not such a significant source of concern compared to eight years ago, due to the great reduction of this media in collections. Today's battlefield needs to look closely at 4 mm and 8 mm data cartridges that hold a lot of final products and rare well log data. These tapes are seriously suffering; recovery is not getting any easier. If you have some of these in your collection, I strongly recommend that you kick into gear and save what you can, whilst you can.

What is negative time?

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Negative time is an interesting concept. It invokes images of time travellers going back to the past and changing the course of history. Recently, two things got me thinking about going back in time.

The first is quite eerie and links the dates 1965, 1976, 1988 and 2012. Two years ago, my wife, Sharon, received a postcard as a 'secret Santa' present. Sharon collects old things (like me) and one of her friends thought this card (Figure 1) would be an appropriate gift. The postcard was sent from Mawson base in Antarctica in February 1965 and the stamp cost 5 pence – a year before the introduction of decimal currency in Australia. The written message is unremarkable: it describes the weather and mentions a girl, but what is interesting is the signature.

The card is signed by John Haigh, a well-known geophysicist and prime mover in the establishment of Geoex – an Australian geophysical contracting group based in Adelaide until 1983. My wife's friend did not know that John and I were geophysicists. Somewhat eerie? Here is the spooky bit. John gave me my first job in the exploration industry, hiring me in 1976 to work in an IP crew based in Cobar. He also hired other graduates that year: Nic Limb, Chris Anderson and Andy Mills – all of whom became well regarded in their fields. In 1988, John succumbed to a brain tumour, a great loss to both his family and the industry. A staunch supporter of the ASEG, John co-chaired the ASEG/SEG International Geophysical Conference and Exhibition (Adelaide 88) at the time of his death.

Although the first event is quite weird, the second is just annoying. Whilst attending a prospect presentation recently, I noted one of the displays had seismic two-way travel times shown as negative numbers. Geophysically, this is just wrong. Two-way travel time is a measure of the time it takes for a seismic wave to travel from the source down to a reflection point and back up to a receiver. It can't be less than zero. A negative two-way time implies a reflection arrives before the activation of the source. We all know this is impossible. Yet no matter how incorrect, the vendor of one of the industry's most used software packages insists on using negative time values for seismic displays and calculations. As far as I know, this vendor has no plans to change this sign convention – I believe this shows contempt for industry standards and conventions. How hard is it to program software to conform to established practices?

This may seem pedantic, but it has a daily effect as data moves from one software package to another, or when calculations involve two-way travel times.

There are geophysical uses for negative time (used in its proper sense). For example, it is common for seismic vibrators to use an upsweep, whereby the sweep starts at low frequency and increases to the high frequency, despite some advantages in down sweep acquisitions. Mathematically, the harmonic ghosts, created by an upsweep, occur in negative time on the correlated records, before the sweep start time – thereby eliminated.

So what is negative time? It can be in the past, if you are Dr Who travelling the universe, or an old geo reminiscing, it can be a mathematical convenience, or if you like to do your own thing and cause havoc, it can be the two-way time of a reflector below ground level. I think I'll stick to reminiscing.

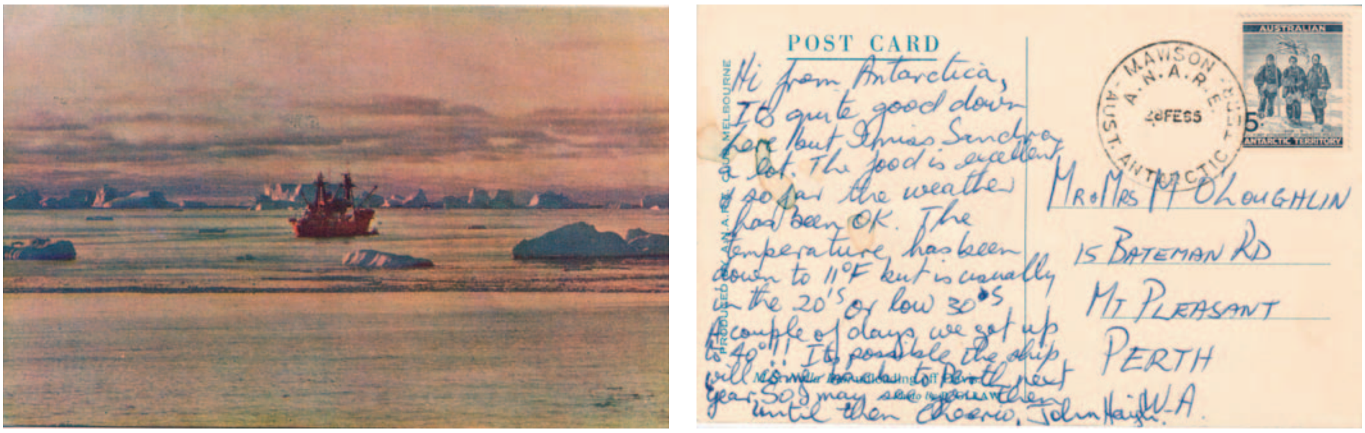
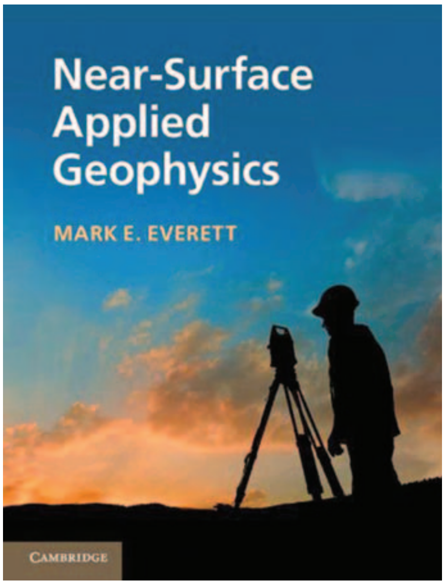


Fig. 1. *Front and back of a postcard sent from Antarctica by John Haigh on 28 February 1965.*

Near-Surface Applied Geophysics

by Mark E. Everett



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Near-Surface Applied Geophysics, by Professor Mark Everett from Texas A&M University, is a comprehensive introduction to the techniques used within shallow geophysical surveys. This textbook, aimed at senior undergraduate and graduate students specialising in geophysics, comprehensively summarises the theory behind magnetics, electrical resistivity, induced polarisation, self-potential, seismic reflection, refraction and surface wave analysis, electromagnetic induction and ground-penetrating radar; as well as introducing emerging techniques: surface nuclear magnetic resonance, time-lapse microgravity, induced seismicity studies, landmine discrimination, passive grand-penetrating radar (GPR) interferometry and seismoelectric coupling. Professor Everett, who is particularly know for his work on important archaeological sites, such as the D-Day landing site in Normandy and on the island of Alcatraz, also provides a comprehensive introduction to linear and non-linear inversions during the concluding chapters of this volume. This is a challenging and rigorous text well supported by clear illustrations that is sure to become an important part of university curricula around the world and should find a happy home with the libraries of many practising geophysicists.

The greatest strength of this book is the in-depth discussion of each specific technique which is well augmented by pertinent case studies. For example, GPR scholars will be gratified by the excellent discussion of topics such as the GPR fundamentals, dielectric constant and electrical conductivity, dielectric properties of rocks and soils, resolution, data acquisition, basic data processing, electromagnetic plane waves, GPR antennas, GPR radiation patterns and target polarisation. All topics are concisely discussed, supported by suitable equations, diagrams and illustrations and suitable references which effectively facilitate further reading. The case studies in the GPR chapter include the mapping of bedrock to predict the vector of perchlorate transport by groundwater, the detection of plastic landmines, mapping of depositional facies in a coastal dune and the location of voids beneath reinforced concrete, provide a good cross section of possible applications of this method. The inclusion of a chapter on emerging geophysical techniques is particularly interesting, although some readers, particularly in the agriculture sector, may be disappointed by the omission of radiometrics.

Whilst I am very impressed with this book overall, I am disappointed that Professor Everett did not include a chapter on survey positioning. Effective use of appropriate techniques is particularly important in the high-resolution surveys undertaken for small and subtle geophysical targets found in shallow geophysics. Although this field is outside of the explicit remit of geophysics, an introduction to differential GPS, Real Time Kinematic-Differential PGS, Total station, Robotic Total Station and high-resolution photography and photogrammetry using unmanned aerial vehicles and satellite platforms is essential for any contemporary geophysical survey in this field. It is disappointing that the author chose to repeat greyscale figures shown in the text as colour in the plates section. I believe it would have been more appropriate to include a broader selection of images for this very visual discipline, referring the reader to the plates section to show those best displayed in colour. My major criticism of this text is, however, that the introductory chapters and the beginning of each section on a particular technique failed to enthuse me about the great potential for geophysical methods to make an important contribution to society. Everett is clearly a passionate practitioner and an outstanding scholar in the field of near-surface geophysics, but his dry writing style and immediate concentration on technical topics such as data analysis is a shame. I can't help feeling that those students who are new to this area – or perhaps augmenting their skills beyond some of the areas serviced by shallow geophysics such as geology, environmental science, engineering, archaeology and agriculture – may not be stirred to put in the hard work that this book deserved.

Despite these minor criticisms, this book provides a solid intellectual foundation to advanced students discovering near-surface geophysics for the first time, thus deserving a place in every geophysicist's library. Whilst it is not the most accessible book on the market, it is rigorous and comprehensive. I anticipate that my copy shall be well thumbed by repeated readings over time.

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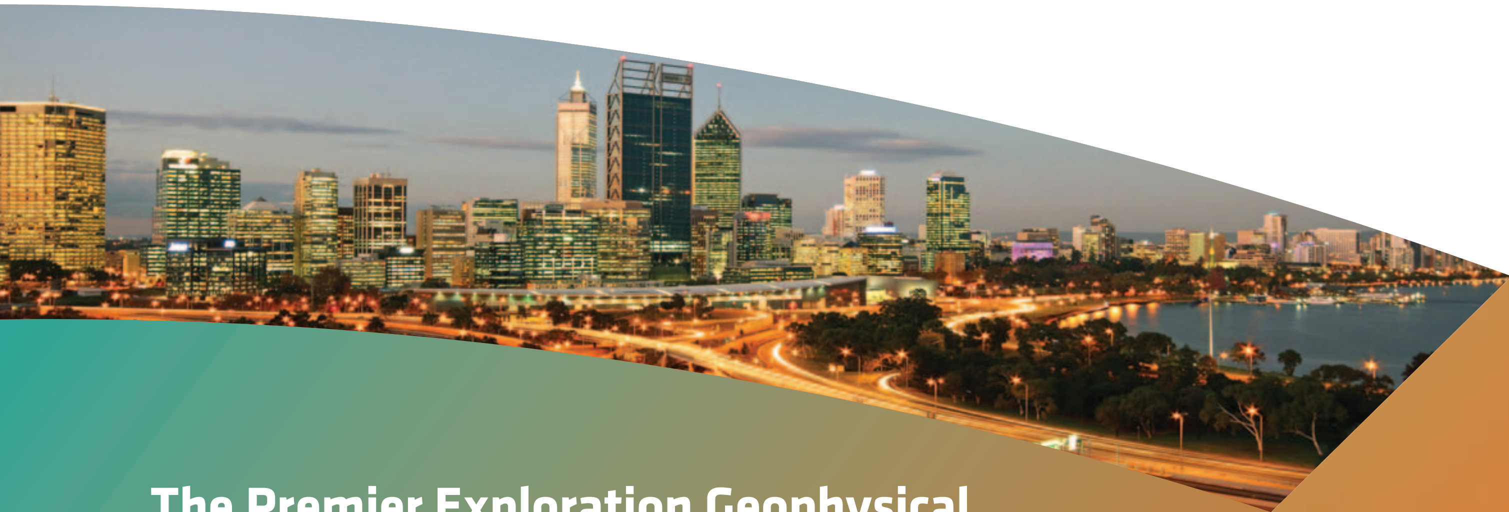

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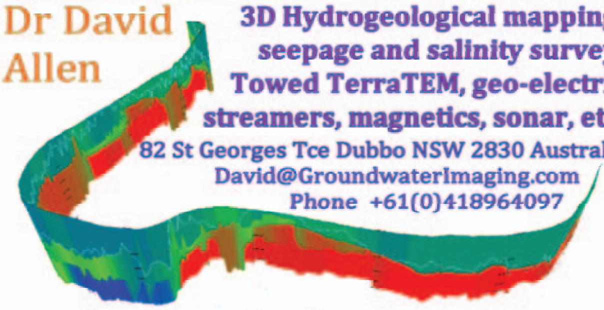

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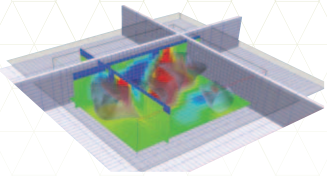

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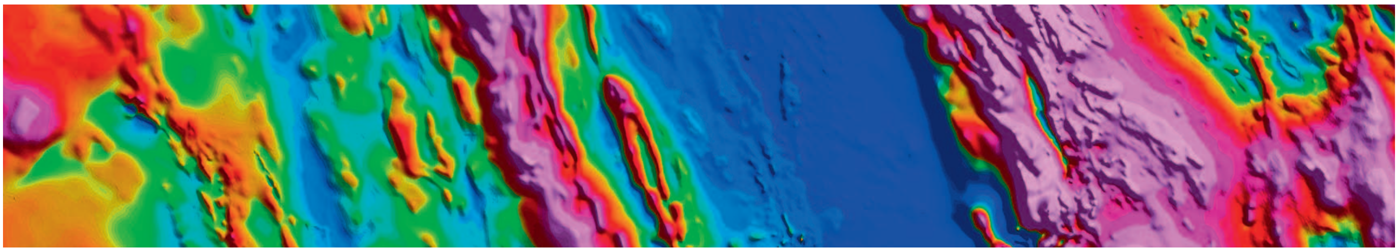

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28–2 Oct	2014 Canadian Geotechnical Conference *Conference website pending. Please email cgs@cgs.ca for additional information or visit the CGS website (www.cgs.ca).*	Regina	Canada (Saskatchewan)
October			**2014**
21–23	131th SEGJ Conference www.segj.org	Shizuoka	Japan
26–31	SEG International Exhibition and 84th Annual Meeting http://www.seg.org	Denver	USA
27–29	KazGeo 2014: From Challenges to Opportunities http://www.eage.org	Almaty	Kazakhstan
December			**2014**
10–12	The 8th International Petroleum Technology Conference (IPTC) http://www.iptcnet.org	Kuala Lumpur	Malaysia
January			**2015**
11–14	3rd South Asian Geosciences Conference and Exhibition http://geo-india.com/	New Delhi	India
February			**2015**
15–18	ASEG–PESA 2015: *Geophysics and Geology together for Discover* 24th International Geophysical Conference and Exhibition http://www.conference.aseg.org.au/	Perth	Australia
March			**2015**
18–21	PACRIM 2015 http://www.pacrim2015. ausimm. com.au	HongKong	China
May			**2015**
17–22	20th Caribbean Geological Conference http://www.thegstt.com	Port-of-Spain	Trinidad and Tobago
June			**2015**
1–4	77th EAGE Conference and Exhibition 2015 http://eage.org	Madrid	Spain
July			**2015**
7–10	Near-Surface Geophysics Asia-Pacific conference (NSGAP) (website TBA)	Waikoloa Village (Hilton), Hawaii	USA
October			**2015**
18–23	SEG International Exhibition and 85th Annual Meeting http://www.seg.org	New Orleans	USA
December			**2015**
7–9	The 9th International Petroleum Technology Conference (IPTC) http://www.iptcnet.org	Doha	Qatar
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