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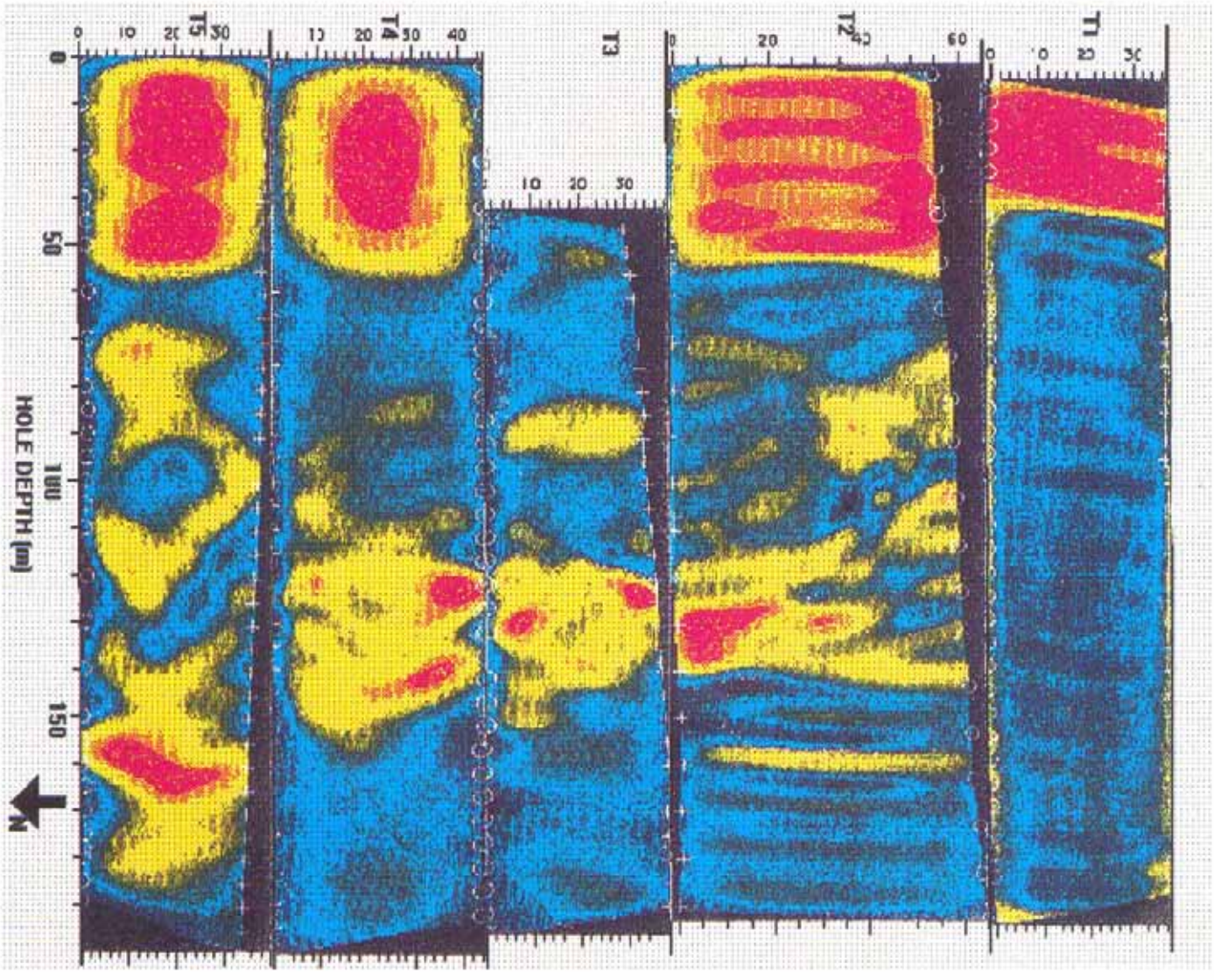

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Editor's Desk

Announcement

SEG meeting, Denver November 10-15 1996

This meeting promises to be the best Mining Geophysics meeting (outside Australia !) for years. There is a real determination on the part of the Technical Program Committee to put mining back into the schedule. There is no mining-related special symposium preceding the SEG, and no ASEG meeting in 1996.

As one of the most active mining geophysics communities in the world, WE have to contribute to putting mining back into the International SEG Meeting this year. Plan to be there.

Closing date for submission of preliminary abstracts is April 15 1996. Dig out an interesting case history. It takes work for a presentation and/or paper, but its an excellent professional development exercise, and it contributes to the strength of our profession. Contact the SEG, Tulsa USA, Fax 0011 1 918 493 2074.

Michael Asten - First Vice-President.

Special Editor - 12th ASEG Conference

The ASEG invites applications for the position of Special Editor(s) for the Conference Number of "Exploration Geophysics" to be published at the time of the 12th ASEG Conference to be held in Sydney in March 1997.

The special Editor(s) will be responsible (with the Editor, and with the Conference Technical Program Committee) for the technical content and presentation of the Conference Number. In particular this will entail ensuring adequate refereeing of written papers and adherence by authors to ASEG standards.

In line with all ASEG offices, the position is unpaid, but in recognition of the particular demands of the task an honorarium will be payable following publication. Assistance with rental of necessary office equipment and/or secretarial support will be considered.

Applications should be directed to Michael Asten, Chairman of Publication Committee, at the ASEG Secretariat, or phone (03) 9545 4734 for further information.

President's Piece

Although I intended to review the Adelaide Conference, Craig Gumley's summary last issue comprehensively covered it from a far more informed position. Adelaide was a great success, largely to the efforts of the Organising Committee. I must also single out, as did Craig, the Herculaean work of John Denham as the Special Conference Editor and unflagging efforts of Danny Burns as head of the Technical papers committee. The Conference Organisers, Intermedia, ensured that it was one of the more efficiently run conferences I have been to.

I'd like to cover a number of topics with you in this Piece which ultimately affect the health of the Society. The most important financial impact by far on the Society is from the publications. As in most technical societies, the journals are the greatest financial sink. This is perhaps even more true for the ASEG than for many societies because of the very large conference volume published every 18 months. Greg Blackburn, in the Executive Brief last issue, invited you to respond to the poll on publication policy. I hope that many of you found the time to provide us with your thoughts.

The Publications Committee was adamant that before making any major policy shift concerning the Society's publications that the membership at large had to be canvassed. Once they have analysed that response and consulted with the Executive, the 1997 Sydney Conference Organisers and the Conference Advisory Committee, they will recommend a future set of Guidelines which will be presented in Preview. Exploration Geophysics is the "flagship" of our Society and to a large extent represents Australian exploration geophysics to the rest of the world. As such, its scientific and technical level will, of course, be of primary consideration.

I'd like to encourage those authors who need more than three pages to describe their findings and who believe that a more formal referee review will enhance their paper to consider submitting for publication in non- conference volumes of Exploration Geophysics. The referee process always improves a paper, sometimes quite substantially. John Denham and others have worked hard to close the gap between the submission and publication date and the time now compares favourably with most other journals.

The Executive will be moving to Brisbane following the next AGM, probably in late April and we hope that it will be a seamless transition. Representatives from Brisbane are already attending the Federal meetings. The Executive has resided for three years in Melbourne. Prior to the move to we'd like to complete, for lack of a better term, a "corporate plan" with a proposed strategy to help keep the Society financially healthy into the future. Because of the major financial and "spiritual" influence of the Publications much of the discussion thus far has centred around them.

Other areas requiring some guidelines concern the establishment of a Secretariat and level of support for publication (for layout and production editing). The ASEG offices will remain in Melbourne even with the transfer of the Executive but we hope that the new email access will help to keep the lines of communication open. A larger issue is that concerning support generally. Companies are increasingly reluctant to contribute staff time and resources to supporting professional societies. A much higher proportion of active committee members are often self employed.

As alluded to in the last issue of Preview, these changes will probably need to be addressed by the establishment of a permanent Secretariat with one full time employee to provide continuity and support for the members active in the Society. The role and the financial implications will be considered in the "corporate plan".

Looking to the future I'm sure many of us are looking forward already to the Sydney Conference in February 1997, co-hosted by the SEG and PESA and chaired by the very capable, experienced (and colourful!) Roger Henderson. Roger chaired the last Sydney conference, but has fallen prey to a masochistic streak and has taken on the massive task once more. One of the easiest ways that you can help the Society manage its finances and organise its resources is to ensure that you meet the paper submission deadlines religiously. These are provided on the back page of the first call for papers. The deadline for titles and abstracts is the 15 March (homage to Shakespeare?). Beware!

Kathy Hill
ASEG President

Preview - Next Issue

- *High Resolution Shallow Marine Seismic*
- *50 Hertz Hurts*
- *Seismic Data Storage at BRS*
- *ASEG Membership Survey Results*

Executive Brief

Welcome to the last edition of Preview for 1995. Initial response from the 1996 ASEG Membership Census, which was included with the recently posted Notice of Subscription Due notice, shows a clear preference for a combined Preview and Exploration Geophysics volume (6 issues per year). While it is not too late to pay your 1996 subscriptions, your input into deciding the future fate of the ASEG publications is limited as the Federal Executive will soon finalise their decision (more on this next issue).

Sydney Conference

The first announcement and Call for Papers and Posters for the ASEG 12th Geophysical Conference & Exhibition to be held in Sydney from 23-27 February 1997 was recently distributed to all ASEG members. The Society is co-hosting the conference with the Society of Exploration Geophysicists (SEG) and the Petroleum Exploration Society of Australia (PESA). The conference will focus on Asia Pacific exploration. Deadlines for titles and abstracts (up to 4000 words) are 15 March 1996, with receipt of papers for technical and editorial review by 15 June 1996, the same deadline date for submissions of poster synopses. Mid March is not far away so please rally around and make the Sydney Conference a great success. For further details contact:

ASEG 1997 Conference Secretariat
Conference Action Pty Ltd
PO Box 1231
North Sydney NSW 2059
Tel: (02) 9956 8333
Fax: (02) 9956 5154

Federal Executive

The Federal Executive is on the move. As from the next AGM in April 1996, the Executive will be located in Brisbane. The secretariat will however, remain in Melbourne. At present the Executive is liaising with a steering committee comprising Henk Van Paridon, Robyn Scott, Peter Hatherly, Peter Fullager, Mike Shalley, Steve Hearn, Wayne Stasinowsky, Noll Moriaty, Koya Suto and Andrew Mutton to facilitate an orderly transfer of knowledge and information. The final executive will be formalised following their election at the April AGM.

Happy New Year

By the time this issue hits the letterbox the Christmas cheer will have subsided. On behalf of the Federal Executive I extend to all a happy and successful 1996.

Greg Blackburn
ASEG Secretary

Notice of ASEG Annual General Meeting and Election of Executive Committee

Following the 1996 AGM to be held at the Kelvin Club, Melbourne Place (off Russell Street), Melbourne on Tuesday 30 April 1996 at 6.00pm, the ASEG Federal Executive will transfer from Melbourne to Brisbane. The ASEG Nominations Committee has received and accepted the following nominations for the 1996/97 ASEG Federal Executive:

President:	Henk Van Paridon
First Vice President:	Steve Hearn
Second Vice President:	Wayne Stasinowsky
Secretary:	Robyn Scott
Treasurer:	Peter Fullager
Editor Preview:	Mike Shalley
Committee:	Noll Moriarty
	Koya Suto
	Andrew Mutton
	Peter Hatherley

The Nominations Committee is seeking further nominations for the abovementioned positions. All nominations including details of the Nominator and seconder should be sent to:

ASEG Secretariat
411 Tooronga Road
Hawthorn East Vic 3123
Ph: (03) 9822 1399
Fax: (03) 9822 1711

by 26 April 1996. Nominations will be accepted prior to the election at the AGM.

ASEG Branch News

ACT

The ACT Branch of ASEG during the last few months has had a number of meetings/seminars with guest speakers including **Prof. Kurt Lambeck** (RSES, ANU), **Prof. Brian Kennett** (RSES, ANU), **Dr Prame Chopra** and **Dr Peter Gunn**. The topics of the seminars have ranged from studies of "ice sheets, sea level changes and physics of the Earth" through to a "practical demonstration of the World Wide Web" and "TMI data interpretation".

A Christmas function is being held jointly between the local branches of ASEG and GSA on Friday 8th December 1995 at the Old Canberra House (ANU) with 'mystery' entertainment being organised for the evening.

The Australian geoscience industry should be made aware that during 1996 the Australian Geological Survey Organisation (AGSO) (formerly Bureau of Mineral Resources, Geology & Geophysics (BMR for short) will be celebrating its 50th Jubilee, in providing geoscience service to Australia. In conjunction with the Jubliee, the GSA will be holding the 13th AGC in Canberra from Feb 19-23 1996. Truly, an event not to be missed! Attempts are also being made to hold a Jubilee Dinner in the Great Hall of the new Parliament House, a rare experience indeed.

Best wishes to the geophysics community for a Merry Christmas and prosperous New Year.

Kevin Wake-Dyster
Branch Secretary

South Australia

The SA branch has maintained a hectic schedule of technical talks and social events since June when I last wrote about our activities. Following is a brief summary of presentations and events since that time:

June - Technical presentation by **Richard Smith** (Geoterrex) on Geoterm III, a new multi-component time-domain airborne electromagnetic system.

July - Technical presentation by **Andrew Hugill** (CRAE) on the Self-levelling Gravity Meter which he invented.

August - Joint PESA/ASEG technical presentation by **Dr Helmet Jakubowicz** (Ensign Geophysics) entitled "Down to Earth Seismic Processing".

September - ASEG 11th Geophysical Conference & Exhibition (no SA branch meeting).

October - Technical presentation by **Dr Mike Dentith** (University of WA) entitled "Geophysical Signatures of South Australian Mineral Deposits".

November - Melbourne Cup luncheon and a Student's night.

Our most recent event, the annual student's presentation evening was held at the University of Adelaide Staff Club and proved very successful. The presentations were given as follows:

David Inkster, Adelaide University:

Filtering of Aeromagnetic Data (To Reduce the Masking Effect of Near-Surface Basalt).

Sian Johns, Adelaide University:

An Analysis of Anomalous Borehole Breakouts on the North West Shelf of Australia.

Tim Bart, Flinders University:

The Interpreted Tertiary Stratigraphy and Structure of the Offshore St Vincent Basin, South Australia.

Maris Steele, Flinders University:

Longitudinal Wave Velocity Determination of Nickel Sulphide Ore and host rocks from the Kambalda Mining District, Western Australia.

Sandy Brigg, NCPGG:

Methods of Processing to correct Distortions Associated with Seismic Data over Near Surface Reefs.

Angela Crimes, NCPGG:

Amplitude Variations from Thin Bed Sands in Fluvial Deltaic Environments of the Cooper Basin, South Australia.

All presentations were of a very high standard making judging for the Best Paper and Best Presentation awards extremely difficult. Congratulations to **Sandy Brigg** and **David Inkster** who tied for the Best Paper award, and **Sian Johns** who was awarded the prize for Best Presentation. Thanks to **Dr Richard Hillis** from the University of Adelaide who organised and sponsored the evening.

To finish off the year, our annual Christmas Party will be held on Wednesday 13th December at **Rod Lovibond's** place. This will include a gourmet BBQ and the usual keg of beer as just some if its many attractions. Thanks to Rod and his family for again volunteering to host this event.

We extend our thanks to all people involved in speaking at our technical meetings throughout the year, as well as those companies and individuals who provided sponsorship money. 1995 has again proven the strength of commitment the South Australian Branch has to the ASEG and we hope that 1996 will be just as successful.

Andy Craddock
Branch Secretary

Victoria

Only a few notable goings on in Victoria of late. CRA is presently consolidating in Bundoora. **Greg Houseman** at Monash University has succeeded in bidding for ARC funds in the order of $½M designed to deliver digital seismic recorders for crustal scale tomography experiments. Also at Monash **Garry Massur** and **Justin Ward** supported by ASEG scholarships have successfully completed Honours projects.

Members who participated in the 1995 ASEG wine release are reminded that the Victorian collection point is through **Colin Kerr-Grant** at 1/162 The Esplanade, Brighton, VIC 3186. Colin can be contacted on (03) 9592 2441.

Meetings held in recent months have included presentations by **Dr Richard Smith** from Geoterrex in Canada "GEOTEM III - A New Multicomponent Time-Domain Airborne Electromagnetic System", **Oz Yilmaz** from Schlumberger Geco-Prakla "Inversion of Seismic Data to Estimate Velocity-Depth Models for Structural and Stratigraphic Targets" and **Dr Henry Wu** from Monash University Dept. Of Digital Technology with "Advances in Digital Signal Processing and Compression".

Our next meeting will be scheduled for Jan/Feb 1996 and will feature the election of new office bearers for the Victorian Branch Committee.

Shaun Whitaker
Branch Secretary

ASEG Research Foundation

The ASEG Research Foundation gratefully acknowledges the following donations:

West Australian Petroleum Pty Ltd	**$5,000**
RGC Exploration Pty Ltd	**$5,000**
Western Mining Corporation Ltd	**$5,000**
CRA Exploration Pty Ltd	**$5,000**
MIM Exploration Pty Ltd	**$3,000**
BHP Exploration Pty Ltd	**$3,000**

ASEG RESEARCH FOUNDATION

Post to: Treasurer, ASEG Research Foundation
Peter Priest, Ste 3, 17 Hackney Rd,
Hackney SA 5069

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Aeromagnetic Operations in Canning Basin, 1955

Doug Morrison

Following some prodding from the Editor to supply a brief story or photo or both on some early airborne geophysical operations in Australia I have relented and I hope the following will be of interest to both geophysicists and aircraft buffs alike.

In April of 1955 Aero Service Corporation of Philadelphia, the largest airborne mapping contractor of the time (cadastral, topographical, photographic and geophysical) was awarded a contract by WAPET to both fly an aeromagnetic survey in the then ill-defined Canning Basin of Western Australia and to interpret the results. Although this was by no means the first survey of its type in Australia it was arguably the first in a series of commercial surveys that has continued unabated to this day. I must add that my ad-hoc research into the early days continues and I have recently located that Adastra Hunting were flying their first survey in Australia on the Yorke Peninsula in April 1955 and as such this would predate the following story by a month or so.

The first aeromagnetic survey flown in Australia, according to my research, was a somewhat experimental set of traverses flown by Oscar Weiss for The Zinc Corporation firstly in the Broken Hill area and secondly in the Mount Gambier area (Otway Basin) in 1949. Both the Bureau of Mineral Resources and the South Australian Department of Mines had commenced systematic regional surveys by 1951.

The WAPET survey received a considerable amount of publicity, including national press coverage, with extended articles in The Age 5th July 1955, The West Australian 11th August 1955, etc., and a number of stories in regional newspapers and magazines - this being quite different to the last twenty five years or so where our whole exploration industry and especially the geophysical component rarely gets past a one liner in financial columns. Anyway, from an operational sense and most certainly for all those with an aviation bent, the survey was unique as the aircraft employed was an ex RAAF Mk41 Mosquito!

Left to right: Max Garroway, Paddy McCarthy, Dick Brown, Vince Bertino (wearing a parachute!!), Carl Mauer and Mike Briggs-Smith. Photo courtesy Homer Jensen, Aero Service Corporation.

The aircraft, A52-306, was one of a pair acquired at RAAF disposals in early 1954 (the other being A52-313) by agents, SEPAL Pty Ltd, on behalf of World Wide Aerial Surveys, a joint venture operation of Fairchild Aerial Surveys, Aero Service Corporation and others to fulfil existing US Army Map Service high altitude (36,000 ft) airphoto contracts in Borneo. Both the Mosquitos were immediately placed on the US civilian register (N1596V and N1597V) and were flown to Labuan by Aero Service pilots Joe Mullins and Wally Morley. Due to poor weather minimal (but extremely profitable) production was obtained and in December 1954, both aircraft returned to Sydney where they were hangared at Camden aerodrome.

The installation of the magnetometer system, probably a Gulf Mk II, was again somewhat unique in that the fluxgate sensor was installed inboard i.e., in the fuselage!! - not such a bad idea theoretically, seeing the Mosquito was a wooden aircraft, but the installation was no easy task and proved to be not entirely satisfactory, in fact the initial data quality was determined to be "borderline acceptable" (reportedly, the level shift and quite nice double peaked anomaly produced in the data when the undercarriage was deployed was interesting).

Mk41 Mosquito exA52-306 at Broome mid1955. Photo courtesy Homer Jensen, Aero Service Corporation.

The installation was carried out at Camden by the legendary Homer Jensen and ably assisted by Mike Briggs-Smith of Canadian Aero Service. This work took all of April and most of May but eventually the aircraft was mobilized to Broome on the 21st of May.

To determine priority areas, approximately 7000(!) statute miles of regional/reconnaissance traverses were flown and from this, the survey proper was designed. The formal survey eventually totalled over 20,000 line miles. Navigation and subsequent positioning was by tried and proven methods i.e., by eye! using uncontrolled photomosaics made from K17 photography flown by the RAAF in the late 1940s (coincidently flown by Mosquitos of No 87 Survey Squadron). I can remember planning infill traverses on these crumpled and yellowing mosaics for a later WAPET survey (1963) where they were reused for both navigation and positioning - there was just nothing else available, even as late as the mid sixties!

The survey proper was planned to typical specifications for basin determination - one mile spacing for traverses, flown in bands of three lines, then a spread of ten miles, then another band of lines and so on. The survey was flown at a barometric altitude of 2000 ft and only analogue magnetic data, continuous image tracking film and base station magnetic diurnal data were obtained (altitude control was taken on trust!).

In addition to the Broome field operations a temporary Perth office was established where progressive compilation and a preliminary interpretation took place. This preliminary interpretation was basically used to modify and extend the survey area.

Operationally the survey progressed somewhat slowly with more than the odd hiccup including the mandatory cow destroying the base station sensor and on one flight a more serious occurrence of a complete starboard engine failure shortly after takeoff. This necessitated the jettisonning of the full fifty gallon wing fueltanks, of which one, on the starboard side and adjacent to the dead engine failed to release despite considerable and exotic manoeuvres to do so - much to the consternation of the magnetometer operator (see photo) who was down the fuselage, in near darkness, and in complete ignorance as to what was going on. The aircraft was landed safely following a somewhat tense few minutes. A new, but scarce, engine was shipped from Melbourne on a specially chartered MMA DC3. (It is worth a mention here that Mosquito engines were not renowned as being all that reliable, in fact the above incident was not the first in A52-306s life - a double engine failure at Longreach while still in RAAF service saw a flapless glide landing - but this is another story).

Despite the engine failure and other operational, equipment and navigational problems the crew achieved the odd spectacular daily production, including a record 1184 statute miles (acceptable) in 6 hours 15 minutes total flight time.

The field operations were successfully completed on the 3rd September 1955 and the aircraft returned to Camden.

The crew and personnel involved may not be familiar names to many in the industry of today but in their era they were well known, with some having been in the industry since the inception of the method, they were:-

Bill Lucas (USA) -Project manager, based in Perth
Homer Jensen (USA) - genius
Dick Brown (USA) - crew chief and navigator
Max Garroway (AUS) -pilot
Vince Bertino (USA) - brave mag operator (see photo!)
Mike Briggs-Smith (CAN) - electronics and ground support
Dick Lambert (USA) - dataman
Paddy McCarthy (AUS) - aircraft engineer
Carl Mauer (AUS) -aircraft engineer

I am extremely grateful to Max Garroway, who piloted the aircraft, to Morry Lawrence, who purchased the aircraft from the RAAF, (and who was my first boss) and to Dick Lambert, who was the dataman on the survey and many years ago hired me off the beach into this industry, for their help in accumulating these brief operational details without their personal reminiscences most would have been lost forever.

Composite mag contour maps of the 1955 and 1963 surveys and the associated interpretation have survived in AGSO archives (it would be interesting to investigate how the interpretation still holds up) but I am particularly interested in knowing whether any examples of the raw analogue data has survived - from both a personal interest sake and for addition to my files for possible use in the future History of Geophysics in Australia (if such an animal ever comes about!). If anyone can be of assistance I would certainly appreciate in hearing from you.

Contact:
Doug Morrison
PO Box 575
Lane Cove
NSW 2066

Postscript:

For the aviation buffs the Mk41 Mosquito was a post war Australian built update to the wartime photo reconnaissance PR XVI Mosquito. Only twenty eight Australian Mk41s were built or converted from other types and they were specifically built for high altitude photography. They were powered by twin Packard-Merlin Type 69 (V12s) rated at 1490 hp for takeoff, 1720 hp at 6200 ft and 1565 hp at 17520 ft.

Both A52-306 and A52-313 eventually made it to the Australian civilian register after their sojourn in US colours as VH-WWS and VH-WWA respectively, which is an extremely rare occurrence for ex RAAF aircraft; to my knowledge neither flew any work after registration and were both stripped and ritually burnt at Camden in 1957, a fate which was pretty typical. Only a few poor quality magazine photos have been located of A52-306/N1596V/VH-WWS taken at Broome by the late Homer Jensen and published in an old Aero Service inhouse publication "Propwash". Any others would be greatly appreciated.

and finally in passing

Everyone interested in Australian aviation should look forward to the next few years when the wartime operational PR XVI Mosquito A52-600 (currently under restoration to flying condition at RAAF base Richmond NSW) flys again after fifty years. I personally cannot wait to hear those twin V12 Merlins - noisy - but I've been told the sweetest sound you'll ever hear (if you're a revhead!).

Student Day - Summary Report

Koya Suto
John Mignone
Dave Tucker
Student Day Subcommittee

In association with the ASEG 11th Geophysical Conference and Exhibition, a session for high school students was organised. The main objectives of the session were:

1) to promote geophysics as an area of study/career and its function in the resource industry; and

2) to facilitate community understanding of the development of environmentally non-invasive practices by the resource industry.

During the preceding 11 months, nearly 20 subcommittee meetings were held to ensure smooth execution of a meaningful session and useful resource materials to hand out.

The ASEG Students' Day was held on Tuesday 5th September from 9. 15am to 2pm. The Day consisted of a series of lectures/presentations, tour of the Exhibition Hall, and a demonstration of advanced geophysical software.

Attendees

Invitations were sent to all the 177 State and private high schools in South Australia, of which 26 schools responded positively nominating 150 students. Due to our budget and space constraints, we had to limit the attendees to five students and one teacher per school. Schools were encouraged to nominate girls as well as boys. Final attendees were:

99 students (45 boys, 54 girls),
23 teachers;
3 country schools,
20 metropolitan schools;
8 private schools,
15 state schools;
3 boys schools,
2 girls schools,
18 co-educational schools.
(One school did not attend on the day, because of a crisis in the school.)

Further invitations were distributed to Education officers of state and Federal Mines Departments, Chambers of Mines, PESA, APEA, AusIMM, GSA and AIG. Out of these, the Education Officer of Victorian Chamber of Mines attended.

Session Contents

The day's program was:

- Welcome by Kathy Hill, ASEG President;
- "Into the 21 St Century with Exploration Geophysics", Jamie Robertson, SEG President;
- "Geophysics - Technology to Discover Australia's Mineral and Energy Wealth", Kim Forward, Wesley College;
- "Life as a Geophysicist", Katherine McKenna, Austirex International;
- Guided tour of the Exhibition Hall, and lunch,
- Demonstration of 3D Geophysical Software, Geoquest and ER Mapper;
- "Development of Passive Geophysical Technology to Minimise "Environmental Disturbances", John Mignone.

Presentations

The presentations were planned so that the first two "high-profile" presenters set the scene. This was followed by a technical talk which was the centre piece of the session, and then a lighter talk by a practicing geophysicist. To conclude the last speaker focussed on our environmental concerns.

Gender balance of the presenters was taken into account, in order to promote the option of geophysics as a career for women. The female role modelling was further enhanced with Kathy Hill's participation as the new president of the ASEG.

The students were very attentive, and presentations went well. The morning session over-ran by about 10 minutes, which reduced the tour and lunch time and kept tour guides waiting.

No break was planned during the morning session, which contained four talks totalling one and three-quarter hours. In retrospect, a short comfort break could help the attendees.

Guided Tour in Exhibition Hall

The students and teachers were taken to the Exhibition Hall between 11.30 am and 12.45 pm escorted by volunteer guides from ASEG delegates. The average size of groups was 5 students, 1 teacher and a guide. This necessitated 20 volunteers. They were collected through personal contacts of Terry Crabb (from the minerals industry, government and academic organisations) and Koya Suto (from the petroleum industry). The guides had a variety of affiliations with the exhibitors, which successfully avoided over-crowding particular areas in the Exhibition Hall.

The concern of overcrowding by bringing over 100 teenagers into the Exhibition Hall, initially anticipated by the COC, did not eventuate. This seems to be because the exhibition area was large enough to accommodate the numbers) and their lunch time was offset from delegates' with a relatively small (15 minutes) overlap.

No damage or complaints were reported by the exhibitors. At the exhibitors' meeting, an exhibitor expressed that he would liked to have more time to explain geophysics and his product to the students.

Students and teachers also liked the tour and talking to the guides and exhibitors.

Software Demonstration

The software demonstration was provided by Schlumberger-Geoquest and ER Mapper using Silicon Graphics hardware. The products were excellent and impressed the audience enormously. Setting up the computer took longer than anticipated which reduced the demo time.

Resource Material

Students and teachers were given a satchel each. The students satchel included, the day's programme, abstracts of the presentations and "Woman in Geophysics" (both reprinted from Preview), Petroleum Resource Book by Australian Institute of Petroleum, Mineral's Guidebook by MESA, literature on airborne surveys by World Geoscience, Career Guide by MESA, pads donated by Santos, pens donated by ECS, a poster from BHP, a geophone donated by Geosystems with an instruction sheet for connecting to a cathode ray oscilloscope, etc. In addition the teachers' satchel included a minerals exploration case study produced by John Mignone of MESA, a petroleum exploration case study by Andy Mitchell of NCPGG, software of earthquake seismology donated by Gary Gibson of Seismology Research Institute of RMIT and two video cassettes of a 3D seismic survey donated by Boral and GFE. There was little time for the attendees to check the contents, and no feed back has been heard yet.

Attendee's Response

A questionnaire was issued at the end of the session. Exactly one hundred attendees (80 students and 19 teachers plus one Victorian Chamber of Mines officer) responded to the questionnaire. Of them 96 enjoyed the day, (one didn't and three did not answer). To the question "Should this event be offered again?", 99 out of 100 respondents answered "Yes". This indicates the overall success of the Students' Day.

Twenty students felt the Day was too long, while 58 students and 18 teachers felt the length was appropriate. If a morning tea break was included, we consider that some of the 20 students would have been satisfied.

Many respondents expressed a desire for a longer exhibition tour and hands-on experience

Full analysis of the questionnaire is available in the main report to the Federal Executive.

Subcommittee's Comments and Recommendations

With the very positive responses from session attendees and ASEG delegates, the sub-committee is proud of the successful session. The Sub-committee would like to share this success with the companies, organisations, individuals and COC that supported the project. A full list of acknowledgments is included in the main report. It is recommended that a similar offering be organised in future conferences.

The ASEG should be proud of, firstly, the inspiration of the concept of the integrated students' session, and for it being reality through sponsorship of its supportive members. This is an unparalleled precedence which has been set.

To improve the students' and/or possibly community sessions, the sub-committee make the following recommendations.

Organisational

- The program needs to include a break or two between presentations.
- More time for tour and "hands-on" experience as requested by the attendees.
- The guides are considered essential to provide personal contact and to promote relaxed informative conversation. This also provides supervisory function and group management.
- As for "hands-on" experiences, this committee provided curriculum resources for every school to use in their classroom setting. The students seemed to be more impressed by the modern computer technology. Inclusion of computer applications in geophysics is considered impractical in view of time constraints and background knowledge required with the software currently available.

  An alternative idea is to have a booth dedicated to students throughout the conference duration manned by rostered exhibitors featuring touch screen facilities
- The career guidance session, (originally a part of the planned presentations but had to be shortened by time constraints,) should be included in the presentation, not just in the satchel hand-outs.
- The merit of having the Education and Community Liaison Coordinator of MESA, Mr John Mignone, in the committee was invaluable. His experience in this area and readily established contacts eliminated a great deal of difficulty which, we would have otherwise encountered. In future conferences, it is recommended that the COC seek a person in similar role in the relevant state to help with organisation.

Extension

- As an extension of Students Day, a community forum between the people in the industry, teachers, government, lobbying bodies etc. was suggested. This idea came rather late in the organisation and could not be implemented. It is recommended for consideration for the next conference.
- The Students' Session was well mentioned in the various speeches during the conference, but not well publicised in the program and other preprint material. Practicing geophysicists should be encouraged to attend the session and have an opportunity to talk with students. A higher profile to Students' Day in publicity is recommended.
- The spouse of a member geophysicist attended the student session. She enjoyed the day, particularly, in learning about what her partner does for a living. This led to the idea of opening the students' session to the spouse's programme. This is recommended for consideration.
- Although the questionnaire indicated a great majority supports a repeated session, the conference only comes to a host city every 7 or more years. A similar session could be carried out by the ASEG state committees within their state more frequently, say annually or bi-annually, with support from the ASEG Federal Executive. Resource matenals and a slide set and necessary funding needs to be provided by the Federal Executive.

American Geophysical Union

1996 Western Pacific Geophysics Meeting
SEDI Fifth International Symposium
SG2 Symposium: Structure and Dynamics of the Australian Lithosphere

July 23-27, 1996 (Tuesday-Saturday)
Brisbane Convention Centre

Abstract Deadline: 15 March, 1996
http://www.agu.org

Call for Papers

Papers are invited for inclusion in the Program for the Western Pacific Geophysics Meeting as listed above. The meeting is being held in conjunction with the SEDI (Study of the Earth's Deep Interior) Fifth International Symposium and the Geological Society of Australia's Specialist Group on Solid Earth Geophysics (SG2) Symposium on 'Structure anal Dynamics of the Australian Lithosphere'. Arrangements for these two Symposia will be co-ordinated by AGU and submission of papers are to be made in the usual way. Full details of the Program with Session Convenors are given below and can also be seen in EOS (Transactions of the AGU) issue of 19 September; 1995. Details of the Meeting and Abstracts as they are submitted can be viewed on the AGU World Wide Web Site as given above (http://www.agu.org).

Submission of Abstracts

Anyone call submit an abstract and attend the meeting regardless of society membership or nationality. No extra charges are to be made for non-members of AGU. There will be the usual AGU charge for each abstract that can be fulfilled through credit card charge (American Express, Mastercard or Visa), personal cheque, bank draft or official purchase Order. The fee is US$60 for a standard length abstract, but a discount of US$10 is made if payment is received by cheque, credit card or bank draft. Students may submit abstracts for a fee of US$30 only if they are the first author on the paper, but no discount is given. For larger size abstracts the fee is US$70 (Students $40), but no discount is given. AGU will accept payment by personal cheque in Australian dollars (equivalent in Australian dollars will be given in EOS), if submission is made by mail. Electronic submissions of abstracts are highly recommended. Instructions for such submissions will be available on 1 January, 1996. Come into the electronic age and save time and postage You will receive an immediate confirmation of receipt and will then be able to view your abstract with others available at that the on the AGU Web Site. Of course abstracts can also be submitted in the usual way. Details for submitting typewritten abstracts are given in the 19 September, 1995 issue of EOS (Transactions of the AGU). However only electronically submitted abstracts will be available through the World Wide Web Site. The abstract deadline is 15 March 1996 and those sent by courier or through the postal system must be received by 5 p.m. (US E.S.T.) and Email submissions must be received by 1 1.59 p.m.(US E.S.T.). on that date. Mailing instructions are given in the 19 September, 1995 issue of EOS.

Program Committee (Solid Earth Sciences)

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General and Special Sessions

Full descriptions of each of the session listed below are given in the 19 September, 1995 issue of EOS (Transactions of the AGU).

Geodesy

GO1 GPS Crustal Motion Studies in the Australasian Region
Convenor: P. Morgan, Earth Sciences, University of Canberra, P.O.Box 1, Belconnen ACT 2616.
Fax: 06-201-5030. email: peterm@bpl.canberra.edu.au

G02 High Precision Kinematic GPS and the Earth Sciences
Convenor: C. Rizos, School of Geomatic Engineering, University of NSW, Sydney NSW 2052. Tel: 02-385-4205.
Fax: 02-313-7493. email: c.rizos@unsw.edu.au

G03 Local and Regional Geoids
Convenor: B. Kearsley, School of Geomatic Engineering, University of NSW, Sydney NSW 2052. Tel: 02-385-4188.
Fax: 02-313-7493. email: w.kearsley@unsw.edu.au

G04 Colocation and Comparison of High Precision Geodetic Techniques
Convenor: R. Govind, AUSLIG, Srivener Building, Dunlop Court, Fem Hill Park, Bruce ACT 2617.
Tel: 06-201-4371. Fax: 06-2014366.
emal: ramesh-govi@auslig.gov.au

G05 Ocean Dynamics using Altimetry and Radar
Convenor: R. Coleman, Dept of Surveying & SIS, University of Tasmania, GPO Box 252C, Hobart TAS 7001. Fax: 002-240282.
email: richard.coleman@surv.utas.edu.au

GO6 Geodesy in Antarctica
Convenor: P. Morgan, Earth Sciences, University Of Canberra, PO Box 1, Belconnen ACT 2616.
Fax: 06-201-5030. email: Peterm@bpl.canberra.edu.au

Geomagnetism and Paleomagnetism

GP01 Gondwana Paleomagnetism
Convenor: P. Schmidt, CSIRO Div. Exploration & Minerals, PO Box 136, North Ryde NSW 2113.
Tel: 02-887-8873. Fax: 02-887-8874.
email: p.schmidt@dem.csiro.au

GP02 Asia and Pacific Rim Palaeomagnetism
Convenor: Y. Otofuji, Dept of Earth & Planetary Sciences, Kobe University, Kobe 657, Japan.
Tel: +81-78-803-0564. Fax: +81-78-803-0490.
email: otofuji@icluna.kobe.u.ac.jp

GP03 Rock Magnetism and its Applications
Convenor: S. Banerjee, Institute for Rock Magnetism, 251 Shepherd Laboratories, 100 Union Street SE, University of Minnesota, Minneapolis MN 55455-0128, USA. Fax: +1-612-624-6369.
email: chunt@maroon.tc.umn.edu

GP04 Crustal Magnetic Signatures
Convenor: D. Clark, CSIRO Division of Exploration & Minerals, PO Box 1367 North Ryde NSW 2113.
Tel: 02-887-8872. Fax: 02-887-8874.
email: d.Clark@dem.csiro.au

GP05 Properties and Applications Of the Geomagnetic Field
Convenor: F. E. M. Lilley, RSES, Australian National University, Canberra ACT 0200. Tel: 06-249-3406.
Fax: 06-249-0738. email: ted.lilley@anu.edu.au

GP06 Pseudo-Single Domain Remanence, Then and Now
Convenor: D. J. Dunlop, Physics Department, Universtty of Toronto Erindale Campus, 3359 Misissauga Road North, Mississauga, Ontario 5L5 IC6, Canada. Tel: +1-905-828-3968. Fax: +1-905-828-3717.
email: dunlop@physics.utoronto.ca

GPO7 Polarity Superchrons: The Legacy of Kiama
Convenor: N. D. Opdyke, Geology Dept, University of Florida, Gainesville FL 3261 1. Tel: +1-904-392-2231.
Fax: +1-904-392-3584. email: drnognervm.nerdc.ufl.edu

Planetology

PO1 Asteroid and Meteorite Impacts: The Australian Record
Convenor: L. Hamilton, School of Applied Geology, Queensland University of Technology, Brisbane.
Tel: 07-3864-2600. Co-Convenor: A. Glikson, Australian Geological Survey Organisation, GPO Box 378, Canberra ACT 2601. Fax: 06-249-9983.
email: aglikson@agso.gov.au

Seismology

SO1 Earthquake Genesis and Recurrence in Plate Boundary and Intraplate Regions
Convenor: E Smith, Inst of Geophysics RSES, Victoria University of Wellington, PO Box 600, Wellington, New Zealand. Fax: +64-4495-5 186.
email: euan.smith@vuw.ac.nz

S02 Seismic Hazard Assessment in Plate Boundary and Intraplate Regions
Convenor: D. Denham, Australian Geological Survey Organisation, GPO Box 378, Canberra ACT 2601.
Fax: 06-249-9986. email: ddenham@agso.gov.au

S03 Time-Variable Hazards and Prediction
Convenor. D.Rhoades. Fax: 444-569-0003.
email: d.rhoades@irl.cri.nz

S04 Shear-Wave Modelling and Seismic Anisotropy Implications for Compositional Models (on all scales)
Convenor: M. Savage, RSES, Victoria University of Wellington PO Box 600, Wellington, New Zealand.
Fax: +64-4-495-5 186. email: martha.savage@vuw.ac.nz

S05 Improvements in Tomography Analysis (on all scales)
Convenor: S. Bannister, Inst. Geological & Nuclear Sciences, PO Box 1320, Wellington, New Zealand.
Fax: +64-4471-0977. email: s.bannister@gns.cri.nz

S06 Poro-Elastic Media
Convenor: J. Haines, Inst Geological & Nuclear Sciences, PO Box 1320, Wellington, New Zealand.
Fax: +64-4-471-0977. email: j.haines@gns.cri.nz

Tectonophysics

T01 Structure and History of the Australia-Pacific Plate Boundary from New Zealand South
Convenor: T. Stern, RSES, Victoria University of Wellington, PO Box 600, Wellington, NewZealand.
Fax: +64-495-5166. email: tims@tartarus.rses.vuw.ac.nz

T02 Tectonics of the New Guinea Region
Convenor: H. Davies, Dept Geological Sciences, University of Papua New Guinea, Port Moresby, Papua New Guinea. Fax: +675-267187.
email: hdavies@geol.upng.ac.pg

T03 Scientific Retrospective of Ocean Drilling Program Results from the Indo-Pacific
Convenor: R. J. Arculus, Dept Geology, Australian National Umversity, Canberra ACT 0200.
Tel: 06-249-2057. Fax: 06-249-5544.
email: richard.arculus@anu edu.au
Co-Convenor: T. Crawford, Geology Dept, Unxversity of Tasmania, GPO Box 252C, Hobart TAS 7001.
Fax:002-232547. email: tony.crawford@geol.utas.edu.au

T04 Hydrothermal Activity and its Setting in Marginal Basins of the Western and Southwestern Pacific (joint with VGP)
Convenor: R. Binns, CSIRO Div. Exploration & Minerals, PO Box 136, North Ryde NSW 2113.
Tel: 02-887-8741. Fax: 02-887-8921.
email: r.binns@syd.dem.csiro.au

T05 Western Pacific Tectonics
Convenor: C. Lee, Australian Geological Survey Organisation, GPO Box 378, Canberra ACT 2601.
Tel: 06-249-9439. Fax: 06-249-9980.
email: cslee@agso.gov.au

Volcanology, Geochemistry and Petrology

V01 Living with Large Eruptions: Lessons from Recent Volcanic Events
Convenor: W. Johnson, Australian Geological Survey Organisation, PO Box 378, Canberra ACT 2601.
Tel: 06-249-9377. Fax: 06-249-9983.
email:wjohnson@agso.gov.au

V02 Magmatic Volatiles: Timing of Release and Role in E:xplosive Eruptions
Convenor: B. Houghton, Inst Geological & Nuclear Sciences, Taupo, New Zealarld. Tel: 44-7-374-821 1 .
Fax: +64-7-374-8199. email: b.houghton@gns.cri.nz

V03 Lava Flow Emplacement Mechanisms
Convenor: Katherine Cashman, Dept Geological Sciences, University of Oregon, Eugene OR 97403-1272, USA Fax: +1-503-346-4692.
email: cashman@oregon.uoregon.edu

V04 Andesitic Volcanism and Petrogenesls of Subduction Related Magmas
Convenor: Dave Gust, School of Geology, Queensland Univ of Technology, Brisbane. Tel: 07-864-2324.
Fax: 07-864-1535. email: d.gust@qit.edu.au

V05 Hydrothermal Activity and its Setting in Marginal Basins of the Western and Southwestern Pacific (joint with Tectonophysics)
Convenor: R. Binns, CSIRO Div. Exploration & Minerals, PO Box 136, North Ryde NSW 2113.
Tel: 02-887-8741 . Fax: 02-887-8921.
email: r.binns@syd.dem.csiro.au

SG^2 Symposium: Structure and Dynamics of the Australian Lithosphere

SG201 Large Scale Structure of the Australian Continent
Convenor: B. Goleby, Australian Geological Survey Organisation, GPO Box 378, Canberra ACT 2601.
email: bgoleby@agso.gov.au

SG202 Archean and Proterozeic Evolution of the Australian Cratons
Convenor: J. Braun, RSES, Australian National Universit;y, Canberra ACT 0200.
email: jean.braun@anu.edu.au

SG203 Tectonic Evolution of Plate Boundaries Surrounding Australia
Convenor: R. Van der Hilst, RSES, Australian National University, Canberra ACT 0200
email: rob@rses.anu.edu.a:u
Co-Convenor: C. Klootwijk, Australian Geological Survey Organisation, GPO Box 378, Canberra ACT 2601.
email: cklootwi@agso.gov.au

SEDI Fifth Symposium

SD01 Theoretical and Experimental Investigations of the Physical and Chemical Properties of Geological Materials (silicate and oxide minerals, melts, iron and its alloys) under deep mantle and core conditions
Convenor: I. Jacksons RSES, Australian National University, Canberra ACT 0200. Fax: 06-249-0738.
email: ian.jackson@anu.edu.au

SD02 Seismic Evidence for Deep Mantle (including the transition zone and D") and core structure: lateral variations, attenuation and anisotropy
Convenor: B. Kennett, RSES, Australian National University, Canberra ACT 0200 Fax: 06-249-0738.
email: brian@rses.anu.edu.au

SD03 The Geodynamo: Recent Theoretical and Numerical Advances and Observational Constraints
Convenor: D. Ivers, School of Mathematics & Statistics, Sydney University, Sydney NSW 2006. Fax: 02-692-4534.
email: ivers_d@maths.su.oz.au
Co-Convenor: P. McFadden, Australian Geological Survey Organisation GPO Box 378 Canberra ACT 2601.
Fax: 06-249-9986. email: pmcfadde@agso.gov.au

SD04 Geodetic Constraints on Deep Earth Structure Including Mantle Viscosity, Free Core Nutation, and Core Mantle Boundaly Ellipticity
Convenor: K. Lambeck, RSES, Australian National University, Canberra ACT 0200 Fax: 06-249-5443.
email: chair.sedi@anu.edu.au

SD05 Mantle Convection, Including the Thermal Properties of the Deep Mantle and the Role of Thermal Plumes and Subducted Slabs
Convenor: G. Houseman, Dept Earth Sciences, Monash University, Clayton VIC 3168 email: greg@pegasus.earth.monash.edu.au

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In-mine Applications of Radio Imaging

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METS Pty Ltd

Stuart Jeffrey
Cobar Mines Pty Ltd

Abstract

Radio Imaging (RIM) in Australia is now well established in the coal mining industry and shows promise in ore body evaluation in the metalliferous industry. A key advantage of the technique has been the visual display of tomography data and the link that can then be made with actual geology. In coal mining operations RIM is being applied as a risk management tool in longwall panel extraction and as a pre-warning device applied ahead of the development face using horizontal borehole technology. The method is now an integral part of geological hazard evaluation in those mines with high seam gas contents.

A collaborative project is currently under way between Cobar Mines and METS to investigate the viability of RIM as a decision making tool in ore body evaluation at the CSA Mine. Recent experience at Cobar has revealed that significant ore bodies can be missed by current drill hole evaluation methods. RIM trials appear to increase the confidence in cross-hole interpretation and further work is planned to establish the appropriate role for the technology in the mining cycle.

Introduction

Radio Imaging (RIM) was developed in the United States as a by-product of underground communication research by a group of Electrical Engineers based in New Mexico. The technique showed promise in investigating the integrity of longwall coal panels and was marketed world wide through a number of licensing deals with royalty payments channelled back to the innovating company in the US. Other non-coal applications of the technique were envisaged and have been explored to varying degrees, mainly in North America and Australia.

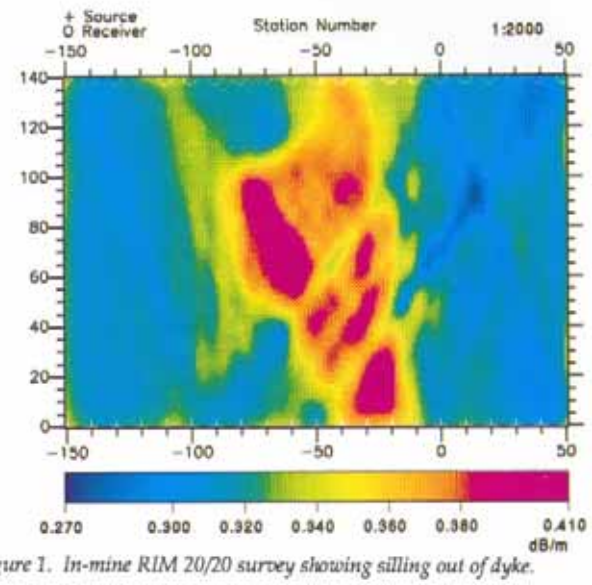
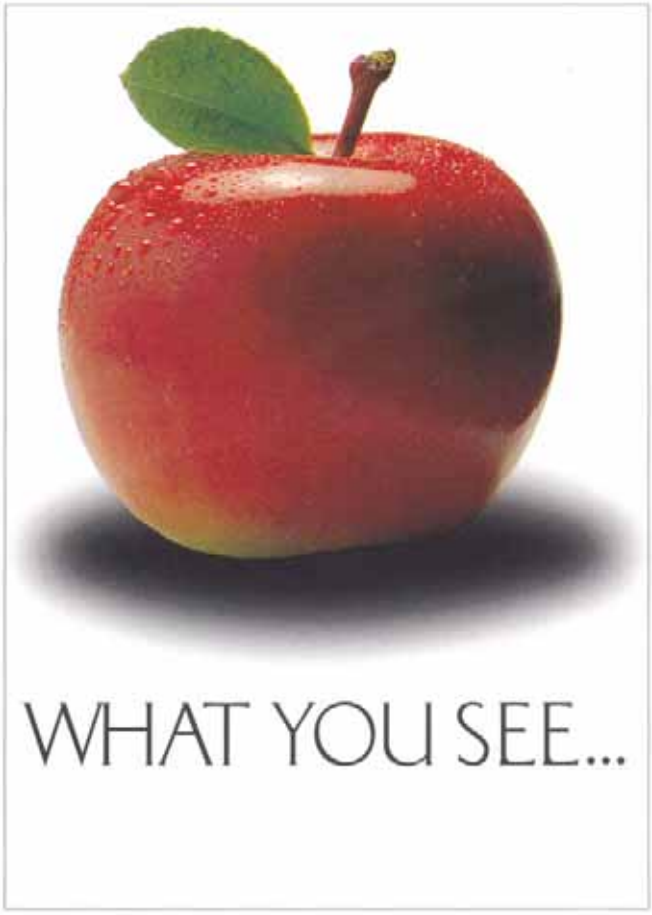


Figure 1. In-mine RIM 20/20 survey showing silling out of dyke.



The method failed to gain widespread acceptance in Europe due mainly to the presence of interfering metal conductors in mine roadways. In South Africa the method had no champion and was not pursued to any significant degree. In North America a longwall market was created with a few steady clients and some preliminary work was done in environmental applications of the technique. In Australia the penetration of the method into operational coal mining has to date far exceeded that of the US, and horizontal borehole techniques have been effectively pioneered in this country. Australia has also provided a large number of metalliferous demonstration sites for RIM on a world wide basis.

Similar equipment has been developed and tested by others with some success in South Africa, Germany, China and Russia. This paper only deals with experience of the STOLAR derived RIM system. Integral to the development of RIM in Australia has been a focus on mine problem solving and an emphasis on visual presentation of results. The approach is based on personnel who understand the questions that mine

operators want answered and a visually appealing tomographic imaging and interrogation package developed by the CSIRO Division of Radiophysics in conjunction with METS operators.

The authors assume the readers basic familiarity with the Radio Imaging Method. Further information may be obtained from other papers, notably Thomson et al (1990), Hatherly et al (1991), Thomson and Hinde (1993), and Young et al (1994).

Radio imaging in coal mining

Coal mine longwall operations have a persuasive need to know about the geology ahead of the shearer. The cost of hitting a 'longwall stopper' exceeds $400,000 a day in lost revenue and usually results in technically difficult and demanding mining conditions as the problem is circumvented.

In development mining, (the key to longwall success) ensuring that seam gas levels are low enough to permit fast extraction of coal is a critical factor in the success or otherwise of the deep underground coal mines of the NSW South Coast.

Radio imaging has a role in both these important areas, for risk management related to longwall panels, and in gas drainage / outburst management ahead of development mining.

Coal mining geophysicists are scarce and almost without exception employed outside the mine operation. Geologists are more common but rarely have the time, experience or inclination to be involved in the interpretation of geophysical data. The main target for mine geological information, the mining engineers and managers, are not interested in interrogating geological or geophysical data in any detail (nor do they have the time). They want

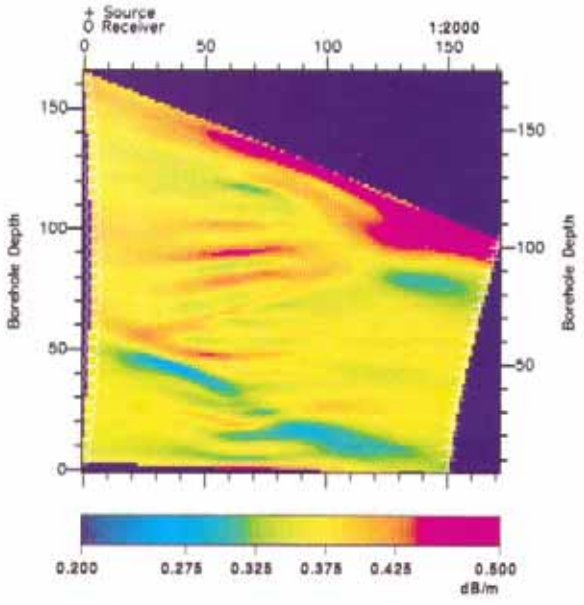


Figure 2(a). RIM II Survey delineating a fault zone at limit of boreholes.

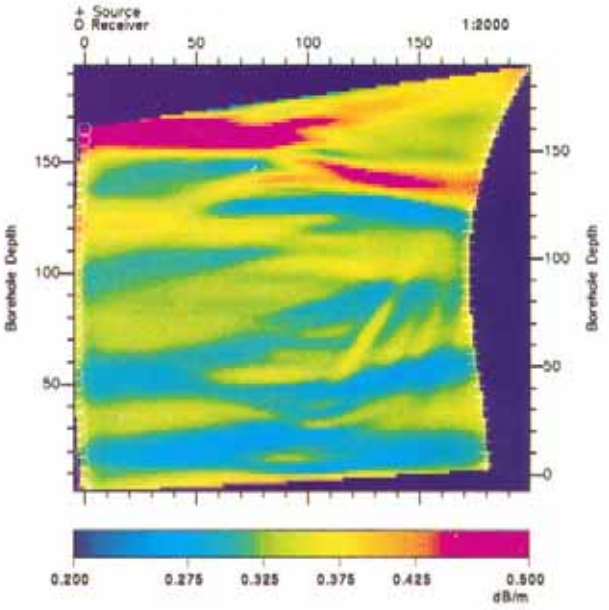


Figure 2(b). Zone adjacent to 2(a) showing a change in fault magnitude.

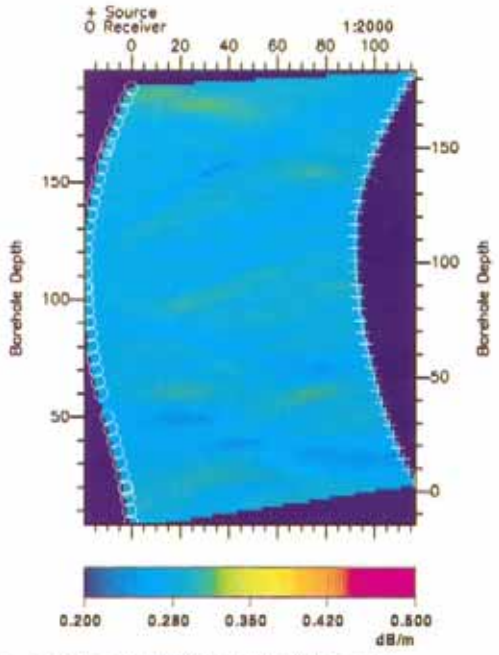


Figure 2(c). Adjacent zone to 2(b) showing "clear" coal.

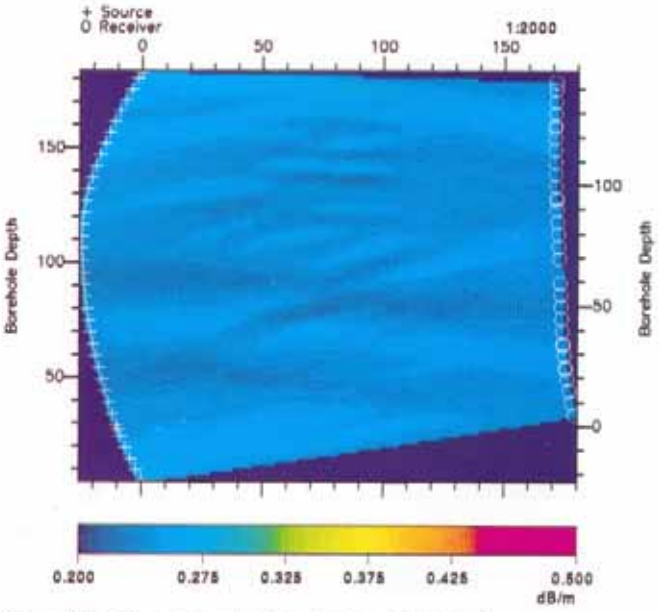


Figure 2(d). Zone adjacent to 2(c) showing "clear" coal.

information they can understand easily, rely on, and use to assist their important mine planning tasks.

It is therefore futile and counter-productive to provide detailed geophysical data to the mine operators to interpret themselves. The key to the successful implementation of RIM (and other geo-tools) is providing a simple, clear-cut answer. Black and white interpretation is called for and operational staff are not tolerant of 'each-way-bet' conclusions.

The implications of this mine culture to the presentation of RIM data is that METS endeavour to provide simple, practically useful results. METS have found that the interactive display provided by the CSIRO Radiophysics software is a powerful tool for communicating the 'message' of RIM to our non-specialist clients. For further information on the philosophy and practice of this software the reader is referred to Rogers, et al, 1987, and Young et al, 1993. The key issue is the value of the software in 'cleaning up' an image to more accurately reflect the predicted geology of the interval at the centre of the study.

A prominent example of the use of radio imaging to manage risk in longwall mining is presented in Figure 1. Here a dyke complex is known to trend across a block and have an aggregate thickness of 1.2m and 0.8m in gateroads (mine roadways). Within the block, RIM shows the dyke to have silled out to many times the thickness intersected in gateroads. This example is taken from a Hunter Valley longwall operation. The experience of igneous intrusions thickening inside a longwall panel is not uncommon and has been repeated with devastating results for production in South Coast and Bowen Basin examples also.

In the RIM image highly conductive dyke material stands out as a high attenuation anomaly (hot colours) from the cool coloured background of clear coal. Coal is known to be uniformly resistive unless affected by geological disturbances such as faults and intrusions. Dykes are particularly conductive due to the alteration effect caused during the process of intrusion.

Ahead of development, RIM may be used to target strike-slip fault structures containing gas and moisture, investigate the shape of igneous intrusions, and validate surface seismic anomalies. The method may be used to quantitatively evaluate the effectiveness of gas drainage or to measure the spread of water infusion into coal. Any one of these examples provides an effective RIM target due to the changing conductivity of the system, and the sensitivity of the technique to this change.

In Figure 2, RIM has been used to evaluate a potential longwall and development area for the presence of potentially outburst prone structures. The four images all use the same RIM frequency and attenuation rate scale. The clear contrast between clear coal and structurally disturbed coal is apparent viewed from right to left. The high attenuation zone in the images in Figures 2(a) and 2(b), was caused by a normal fault of up to 2m throw. The 'clear coal' is uniformly blue, signifying low radio wave attenuation (Figures 2(c) and 2(d)).

The accuracy of the RIM results in this area has subsequently been proved by mining. One of the advantages of the use of RIM in coal mining is that validation of predictions inevitably follows within months (or days!) of survey completion. This has assisted in the interpretation and processing of RIM and raised confidence in the technique from understandably sceptical and conservative mine operators.

Radio imaging in metalliferous mining

From the RIM perspective, the metalliferous mining culture differs somewhat from that of coal mining. Because the technique is still in its infancy in minerals, most surveys are carried out associated with exploration programs and it is generally supervised by personnel with either a background in geophysics or long exposure to the science. In addition, major mining decisions are to date not predicated on RIM results so there is little urgency regarding interpretation. In most cases there is ample time to analyse results in detail and reflect on their implications.

The personnel involved in mineral exploration are used to dealing with geophysical data, although not necessarily tomography. There is a tendency to read too much into an image (the down side of the images is that they look too much like sectional geology) and there is an inherent distrust in the process of using models to 'improve' the initial image.

Minerals is a much less clear cut case for the benefits of radio imaging than that of coal. There are many questions still to be properly answered on the validity of the straight ray path assumption, the effect of off-section conductors, how to deal with induction effects on the antennas, and the width of the influence of the ray path. Nevertheless, there are many excellent examples of RIM images in minerals which have provided cross-sectional data difficult to gain in any other way. There also appears little doubt that RIM is providing valuable data, but how to best use that data is yet to be fully resolved.

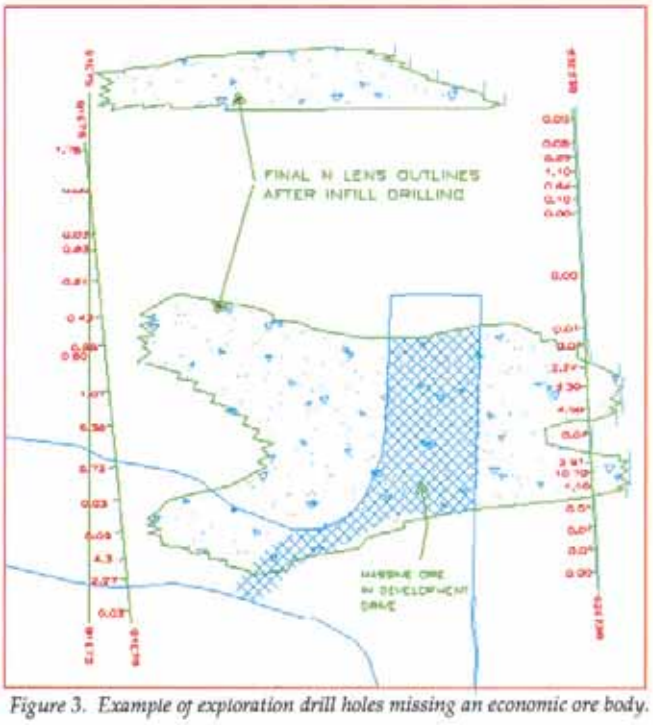


Figure 3. Example of exploration drill holes missing an economic ore body.

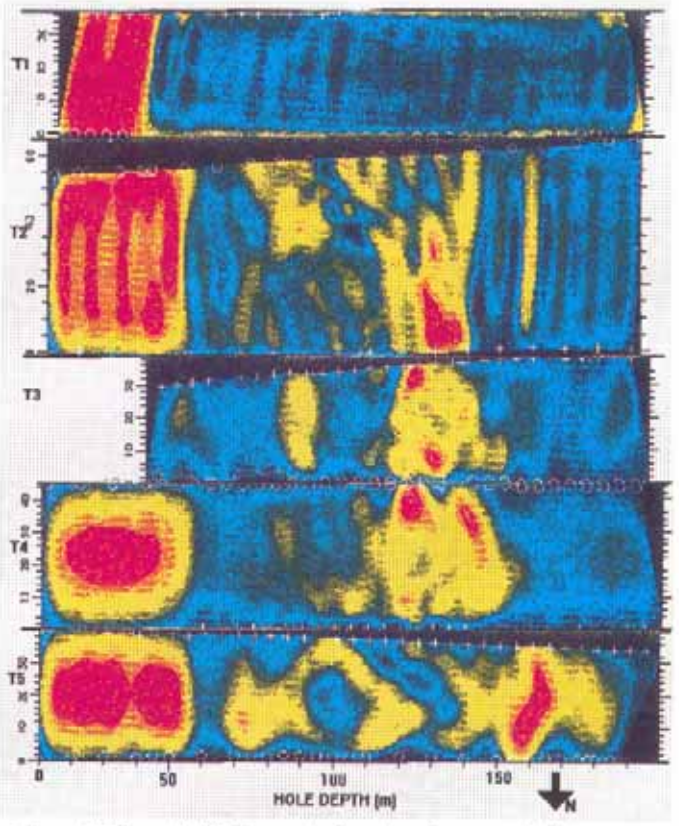


Figure 4. Composite RIM image in plan view of copper ore bodies.

Perhaps the best example of the application of radio imaging to good effect in metalliferous mining is the work currently being undertaken at the CSA Copper Mine in Cobar, NSW (Jeffrey and Thomson, 1995).

Here the high cost of diamond drilling is acknowledged, and RIM is being applied in order to increase the effectiveness of economic mineralisation detection. A Research & Development Project is being applied to develop and/or enhance the existing process for evaluating an ore body and to reduce drilling costs.

RIM has been applied at Cobar since 1993 and has been successful in identifying mineralisation between boreholes. The planar image data is conducive to ore body evaluation and the logistics are simple enough to realistically contemplate incorporating the system into mine scheduling. The geology of the CSA ore body is also suitable for the application of electromagnetic techniques (Doe, et al, 1990).

In the QTS North system at Cobar, a small lens of ore ("N Lens") provided an excellent example of the shortcomings of current evaluation drilling and the potential savings associated with the successful adoption of RIM. Initially, six evaluation drill holes in the vicinity of N Lens covering a vertical height of 100m and lateral distance of 40m indicated patchy copper mineralisation. As an economic lens had not been identified it was agreed to place a drive through this area to access other ore lenses on the 925 sublevel. After approximately 10m of development was completed, a massive high grade copper lens was intersected (Figure 3).

Development was stopped and 1050m of stope definition drilling was completed which identified two ore lenses and three mining blocks totalling 83,600 tonnes at 5.58% Cu (using a 2% cut-off grade). These blocks produced 4700 tonnes of copper metal with an approximate in-situ value of $18.8 million (given metal prices of $4000/tonne).

This case demonstrates how ore lenses can be missed by the narrowest of margins and that there is obviously an advantage in having a geophysical technique that can identify mineralisation between boreholes. From our trial surveys to date, METS and Cobar Mines Pty. Ltd. believe that RIM can provide that benefit.

In 1994 RIM trials in the Western System and Western Gossan Zone at Cobar allowed for a geological interpretation between contiguous boreholes (Figure 4). Comparing the RIM images with known geology reinforced the belief that RIM could detect mineralisation in both areas. The images were carried out using a RIM frequency of 50 kHz. The high conductivity zone at the top of Tomos 1,2,4, and 5 is due to the Western System crown pillar, the high attenuation zones through the basal portion are due to varying amounts of Western Gossan mineralisation.

In an analysis of the sensitivity of RIM, signal strength was compared with pyrite/pyrrhotite content and % metal (Cu + Pb + Zn). At the frequencies used it is apparent that the RIM signal is severely attenuated at metal contents greater than 0.5% and where pyrite/pyrrhotite exceeds 2%. In terms of an economic cut-off grade of 2% Cu this is too sensitive for accurate mine planning. It is however, interesting to note that in Tomo 1 where there is clearly no mineralisation, RIM has provided an unequivocal indication that the interval is barren. This result would not have been possible if RIM had been applied in the aforementioned N Lens case.

METS and Cobar Mines are collaborating on further research into RIM at the CSA Mine, as both organisations perceive that results to date have shown significant promise. Given the positive RIM response and the need for a system to detect ore lenses ahead of mining to avoid the N Lens experience being repeated, it is likely that RIM will eventually play an important role in the mining cycle.

Conclusions

The use of tomographic procedures to express RIM data in coal and metalliferous mining has only been applied rigorously over the last 5-6 years in Australia. The technique has gained widespread acceptance in Australian coal mining and appears likely to continue to be applied as a mine decision making tool well into the future. In mineral mining the system is more complex and there remains for further work to be done on how best to apply RIM data to mine decision making. Recent work at Cobar provides good evidence that RIM can be applied successfully to delineate ore boundaries and it appears likely that the technique will enhance the accuracy of orebody evaluation in those mines with suitable geology.

Acknowledgments

The authors are indebted to the project staff of CSIRO Radiophysics for their hard work, support and persistence in developing the RIM processing package. In particular Glynn Rogers and Jeanne Young have made an invaluable contribution to the increasing acceptance of RIM in Australia. We would also like to thank those METS clients who have championed the method in their various organisations and shared in the highs and lows of the RIM development process.

References

Doe, A.R.D., Carswell, J.T., Smith, C.K., and Erickson, M.E., 1990. Underground Downhole Geophysics at the CSA Mine, Cobar. AusIMM Mine Geologists Conference.

Hatherly, P., Rogers, G., Vozoff, K., Stolarczyk, L., Young, J., Liu, G., McKenzie, B., Thomson, S., and Smith, G., 1991. Development of the Radio Imaging Method for investigating Coal Seam continuity especially between Horizontal Boreholes. Final Report on NERDDC Project 1209.

Rogers, G., Edwards, S., Young, J., 1987. Geotomography for the delineation of coal seam structure. Geoexploration, 24, 301-328.

Jeffrey, S., and Thomson, S., 1995. RIM technology and the CSA Copper Mine, Cobar NSW. A joint Research & Development Project for a Base Metal Mine. Mine Tomography Workshop, QCAT, Brisbane, Sept. 1st, 1995.

Thomson, S., Hatherly, P. and Liu, G., 1990. The RIM I in-mine method - Theoretical and applied studies of its mine exploration capabilities. The Coal Journal, 29, 33-40.

Young, J., Rogers, G., Thomson, S., and Neil, M., 1994. Australian development of tomographic Radio Imaging as a new tool in mining geophysics. Butsuri-Tansa, 47, v.4, 249-255.

The Business of POSC

John Bobbitt
POSC

This article is designed for you to pick your level.

For those of you who have barely heard of POSC, there is the section, **Just the Facts.** This section will give you enough information so that you can knowingly nod your head at the next cocktail party when the conversation turns to POSC. It answers the question "What is POSC?"

For those of you who want a little more, there is the section, **The Business Case.** This will give information on why there is POSC, why it should be of interest to me, and why it must exist. If you read this section, you will be able to enter into the conversation about POSC at your cocktail party. If you thoughfully consider this section, you may even feel obliged to start the cocktail conversation about POSC. It answers the question, "Why is POSC?"

For the technically minded, there is a more technical section on POSC. The **Just the Facts** section will mention the POSC products, but this POSC Products section will give some of the technical details. If you begin dicussing these points at your next cocktail party, you will probably be banished from future ones. This section answers the question, "How is POSC doing it?"

Finally, there is a section, **Adoption of POSC** on the status of POSC data stores and software. This is of interest, because it affects data strategies that companies will be following for the next decade.

Please respond to the article. Ten years ago a response was a stodgy Letter to the Editor. Today, the response can be a direct email to the author: bobbitt@posc.org. There is also a World Wide Web Page that can give much information about POSC. It's URL is http://www.posc.org.

So, pick your level; discuss the cocktail party issues at your cocktail parties; and send me any other comments or issues.

Just the Facts

"The Petrotechnical Open Software Corporation (POSC) is a non-profit membership corporation dedicated to defining an open computing environment for technical applications termed the software integration platform. Developed for the international oil and gas Exploration and Production (E&P) industry, the software integration platform is a set of specifications that addresses:

- Base computing environment.
- Management of data and information
- Access of applications to data
- Exchange of data
- User interface.

"The goal of these specification is to provide oil and gas organizations with methods to manage data resources and to support integrated multidisciplinary projects. Using the POSC software integration platform contributes to this goal by improving the portability, scalability and interoperability of technical applications."

POSC presently has 115 member organizations. Geographically, 55% of these members are from the US, 37% are from Europe, and the remaining 8% are from the rest of the world. A breakdown of type is 15% as integrated oil companies, 56% oil software and service companies, and 29% other, including government agencies and universities. A listing of these organizations are available on the POSC worldwide web server at http://www.posc.org, which also contains links to some of these organizations.

POSC develops specifications and sample implementations of the specifications. POSC does not develop commercial products. In particular, POSC has released the following specifications: Base Computing Standards, User Interface Style Guide, a logical data model and a relational implementation of the logical model, data access specifications to the logical data model, and an exchange specification to allow interchange of the data. Collectively, the logical data model and the data access and exchange specification are called Epicentre (POSC, 1994).

POSC products are available as open specifications to any company or organization. Member organizations have access to the products 3 months before they are released to the public. In addition, member organizations have access to intermediate products and beta versions, from which they can offer input to POSC to guide the development of the products.

A special category of membership is the sponsor level. POSC was founded in 1991 with five sponsors: BP, Chevron, ELF, Mobil, and Texaco. These five companies were instrumental in forming POSC and providing the original funding. Since then, Statoil has also become a sponsor.

The original full product release to the public was in 1994, with the publication of the data model, the data access and exchange standards, and the user interface style guide. The base computing standards were released in 1992. Coupled with the release were sample implementations of the standards in four commercial databases. The sample implementations (with data) were available for companies to use to develop software. These implementations spawned several cooperative projects among oil companies and software providers to develop products and to test the POSC products for viability.

Version 2.0 of the products has been released to members in early 1995. Companies are presently testing these products, and are developing commercial applications on top of these products. The number of cooperative projects has increased to several dozen. Some of the projects have resulted in data stores and software applications that are actively being used in the E&P environment.

In developing this version, POSC formed a partnership with PPDM (Petroleum Public Data Model) to develop a data model acceptable to the membership of POSC and PPDM. The goal was partly achieved. Presently, POSC and PPDM are continuing work towards a final merged data model.

POSC has periodic meetings for the membership. The business forum meets primarily to discuss issues of a business nature relating to the POSC specifications and industry take-up of the specifications. The migration forum focusses more on the technical issues relating to how to migrate from the present environment to the POSC compliant environment. Many of the cooperative projects have presented their goals and results at these meetings.

The Business Case

The POSC Vision

Imagine the following scenario. You are the geophysicist on a team that is managing a reservoir. A fill-in survey to a wide-spaced 3D survey was run over a "bad data" area. The immediate job of the team is to use the information from this new seismic to re-evaluate the drilling program.

You pull in the new seismic to your work station. It is, indeed, much better quality than the original. In fact, you can not only pick the horizons more clearly, but you can also use the data to get a better estimate of the porosities. To do this, you bring in the well logs in the area, and develop analyses of the well log porosities vs. the seismic features. Some conditional simulations give you a good view of how the porosities are distributed - both laterally and vertically.

Given these new structural and porosity maps, the reservoir analyst on the team runs some simulations to decide how to best develop this portion of the field. As the history of production is checked against the new model of the reservoir, it becomes apparent that the seismic interpretation is not quite right. Changes are made to the reservoir model, always consistent with the old and new seismic data over the field. Finally, a good history match is made. New wells are proposed and characterized as producers or injectors. The recommendations are sent to management for approval.

The Reality

How long did this process take? If this were 5 years ago, I would estimate several months. Much of the several months' time would be spent finding the data and reformatting it for the particular software that you need to run. This is an unproductive waste of time.

The POSC vision is that the process should take a few days, and not a few months. This vision is becoming a reality.

Another difference can be illustrated by the process that the previous company I was with had to go through to relate the seismic results to the reservoir analysis. In fact, the geophysicist would "make a map" on paper, and take the paper copy to the reservoir group. The reservoir group would input the model, and use it as a starting point for their analysis. The seismic map was then filed and forgotten. Changes to the reservoir model would not necessarily be consistent with the seismic because the seismic was not available to the reservoir analyst.

Business Problems with a Technical Solution

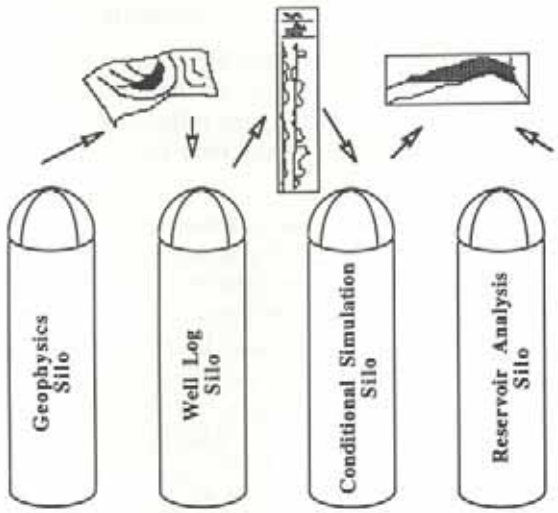
The vision described above is based on a business need - not a technical need. The whole idea behind the POSC initiative is that there is a business problem to solve...there is a business need to be met.

Oil companies are in the job of managing hydrocarbon reservoirs. This management covers the entire life cycle from exploration to final abandonment. The management of these reservoirs involves the collection, storage, usage, and analysis of data and information about all phases of the reservoir. It is incumbent upon the reservoir management teams to have available and to use all of this data at any stage. Thus, the basic driver of POSC is the need for companies to have fully integrated access to all the data for the life cycle of a reservoir (Figure 1).

Figure 1. LifeCycle: The five phases to be managed in the life cycle of the "product" of the oil industry. The future course is to manage the product as a whole rather than having separate groups manage different phases.

There are other business needs that were drivers of POSC. One clearly expressed by many companies can be summed up in the "buy not build" philosophy. Oil companies realized that they were not software companies, but were nevertheless carrying large staffs of programmers and large inventories of software applications. One path away from the software business is to buy applications on the open market. They realize that there are a lot of fine programmers and excellent applications available for purchase. In fact, software was no longer viewed as a speciality product that gave a competitive advantage to the oil company that developed it. It was viewed as a commodity that was widely available at competitive prices on the open market.

But there is a catch - two catches, actually. The first is that a program puchased on the open market did not work with a company's internal database. It is necessary to reformat data to feed it into the application. This adds to the overall cost of the product. The second catch is that each application was its own silo. There were no comprehensive applications that cover all phases of E&P technical data. Instead, an application would optimize the data for its own use (seismic interpretation, or well log analysis, or reservoir simulation), and would not consider the need for this application and the data to be integrated into other areas. The vision described at the beginning of this section is a perfect example of this need since the seismic data and the well logs are used in cooperation with the reservoir simulation program (Figures 2 and 3).



The Old Way: Separate disciplines working separately

The POSC Way: All disciplines sharing their data

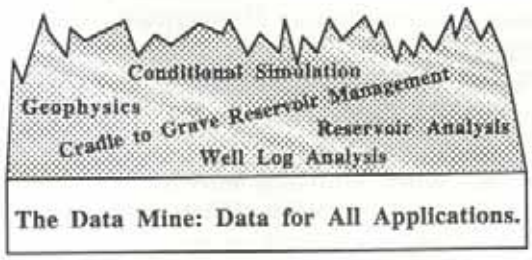


Figure 2. Silos: Each discipline works in its own silo, with its own applications, its own data, its own way of doing things. Communication is done by "throwing maps" from one silo to another. The POSC vision is that they would all work from the same data mine as knowledge teams.

Other business needs include the need to exchange data with other companies, the need to share data among disciplines, the need to manage data, etc. All of these influenced the formation of POSC, and are still drivers of the POSC process.

POSC is Cooperation

The purpose of POSC is to make the data look the same to all companies and to all applications. If that were true, all applications - no matter what discipline they were supporting - would have equal access to all the data. Furthermore, the data would look the same to all companies. So software applications written for one company would also work for other companies.

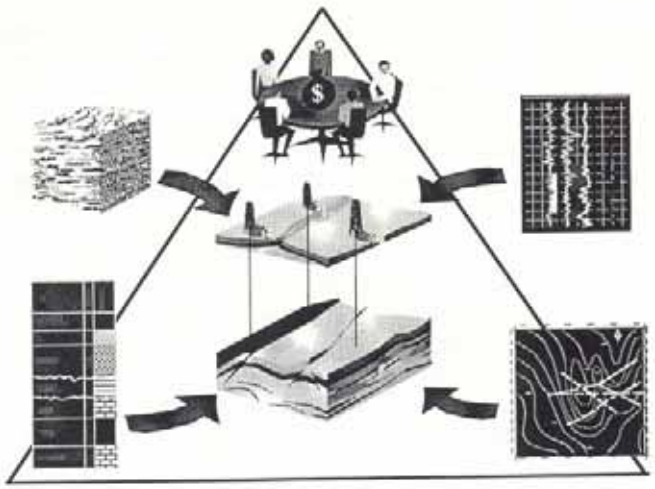


Figure3. Knowledge Teams: In the future, if not already, knowledge teams will be formed to manage a reservoir. The teams will have members from many disciplines, and will need to access the full range of data.

This need is very much a product of the times. Fifteen years ago, before companies were worried about costs, they could each have their own staff to carry out the work that POSC is doing. By moving the main workload to POSC, the member companies are leveraging their spending on this work by sharing the cost.

Oil companies have always been very competitive. In the last five years, though, they have realized that there are areas where they should cooperate. "Compete where you should compete, and coorperate where you should cooperate." POSC is a result of the need to cooperate.

POSC Products

There are good reasons POSC has for each of its products. In my previous positions as a user and as a developer of software, I have been involved with attempts of my company to standardize on these various areas. POSC is the first initiative I have been involved in that is attempting to standardize on the whole platform. The four areas that I will discuss are the base computing standards, the user interface, the data model, and the data access and exchange facility.

The Base Computing Standards

I have developed software for seismic interpretation in the pre-workstation era. I would set up a nice set of menus with checks for errors. I would have diagnostic plots and displays on the screens. I would allow the output to be sent to plotters and printers. I would work with an operating division to insure that the software met their needs.

Then I would take it to another division. Invariably, it would fail. The most common reason for the failure was that the division had a different brand of terminals, or a different plotter, or would have some system switch set differently, or would not have a library supporting my graphic calls. In short, they had a different computing environment.

The advantages on standardizing on a computing environment are clear. The above example indicates why. Many of the problems of portability of software go away when the environment is properly specified. Specifying the environment helps companies when they buy hardware, operating systems, plotting software, etc.

POSC has taken the view that its requirements must be open. It keeps a company (and the industry) from being held hostage by a particular computer company. Likewise, it supports the plug-and-play concept since there are many choices in an open environment. For example, the open systems concept led us the recommendation of Unix as the operating system rather than proprietary packages such DOS, OS/2, Vax VMS, IBM MVS, Macintosh, etc.; each of which has its strong supporters, but each of which would tie the industry to a particular vendor.

The User Interface

Companies have found that one of the largest costs of its computer systems is training. There is a strong monetary incentive to reduce this cost. One way to reduce this cost is to have a common user look and feel to programs. This is also an advantage to users since they don't have to relearn a whole new interface when they pick up a new program. The Macintosh interface, for example, is standardized to the point that users rarely read the manual when they get a new application.

The Motif style guide was approved in the base computing standards, but that was only a start. Motif deals with things such as push buttons and scroll bars. It does not deal with graphics functions, which are key to geologic interpretations.

For example, how do you select a rectangular area on a map? Some applications would have you move to one corner, and click. You then move to another corner and click. Other applications would have you do the same, but you would click the center mouse button at one corner and the right button at the other. Still others would have you start at one corner and drag (hold the button down) to the other corner. All methods are valid, but it would be easier if there were only one.

The Data Model

A major component of the POSC idea is a common data model . The companies decided that there is no competitive advantage in having a "better data model." In fact, the competitive advantage is in having the same data model. This is true, because companies often share data as partners. But even more so, a common data model will allow common software solutions - i.e., off the shelf software that is plug and play.

The first thing POSC did differently in developing this model was to borrow from others. An initial review of the time and effort to produce a data model covering the scope that the POSC companies wanted yielded an estimate of 160 man-years. Clearly this was not acceptable. So POSC requested companies to send them their data models as a starter. With 29 contributions, POSC was able to develop its 1.0 version by the end of 1993.

The second thing POSC did differently was that it hired people with the business knowledge -drillers, geologists, geophysicists, reservoir analysts -to develop the model, rather than leave the job to data modelers. The motivation of these workers was to get the business right. The task of the two people trained as data modelers was to oversee the integration and technical details that the business technicians were putting together.

Of importance to geophysics was that POSC did not rely strictly on relational databases. It has long been known that seismic does not work with relational databases. The POSC data model was built around a hybrid of relational and object-oriented data models. At the time, it was pointed out that these were databases of the future - they were 5 years from being practical. Now, 4 years later, these are viable. The result is a seismic data model that is being successfully implemented.

The result of the process is the Epicentre data model. It is difficult to go into any detail on the model without quickly becoming pedantic. Let the following suffice for this article, and the web page and email suffice for more detailed inquiries.

The Epicentre data model is a very comprehensive data model covering most of the technical areas of E&P data. It is designed to support the business process of the life-cycle of the field. It is implemented in both object oriented and relational databases. It can be reduced in size or extended to meet the particular needs of the company or work group using it. Highly important is that it is expected to change as the E&P business process and technologies evolve. A change management process has been put into place to allow for an orderly evolution.

Data Access and Exchange

When writing a software application, you need to know how to access the data. If everything is done in a closed system in your company, this is usually not a problem. But when you are writing software to be used by any company in the industry, it becomes a major problem.

Likewise, when you buy software on the open market, you want it to access your data. You do not want to be forced to "move" all of your data into the application's database. With many products, that is the only choice.

Thus, the final key to the POSC process is the data access and exchange facility. This is the specification that tells an application how to read and write the data. This is valuable for software companies because they no longer need to spend 80-90% of their software development time developing software to access data in many different forms. They can concentrate on the application and the methods. It is also valuable for user companies because they reap the benefits through reduced costs and reduced implementation time.

The data exchange part deals with the exchange of data between data stores. It carries technical details of how to handle duplicate data (is this well the same as

that well?), missing data (what line do these shotpoints belong to?), etc.

Adoption of POSC

When I wrote the first draft of this article, I wrote it with the view that the industry is on the edge of POSC adoption. I wrote it with the view that there now exists a viable data model and data access standards, but there are no successful implementations yet.

Since then, I have found out how wrong I was. When I started looking into the various alliances in the industry, I have found that there are indeed several Epicentre databases and software applications that are in productive use in the industry. POSC take-up is no longer on the horizon - it is a fact. It would be useful for anyone who is interested in this question to look at the World Wide Web page at http://www.posc.org, particularly at the Projects and Product Directory portion.

How can a company move into the POSC era? There is no simple answer to this question. Instead, there are various strategies. A company can pick the one that works best for it.

At one extreme is the company which says, "I will stay with the way things are until there is enough inertia in the market i.e., when there are a few companies using POSC data stores, and several software applications commercially available, then I will make the switch." This strategy recognizes that it is sometimes better to be a follower than a leader. After all, it is the hiker at the lead who runs into all the spider webs.

But the lead hiker also gets to pick the trail. Other companies are saying that they want to be the leader so that the migration to POSC goes the way they want it to. This strategy is the other extreme from the first mentioned i.e. adopt POSC wholly and completely, and to set about mapping your data into a POSC data store. Companies that have adopted this strategy have found that they come away with a very good understanding of the data model. In addition, they are able to influence POSC into making changes that fit their business. By vigorously examining the data model with respect to its own needs, a company can help POSC fill in missing pieces of Epicentre. Several companies have adopted this strategy by implementing portions of Epicentre.

Figure 4. Alliances: Some of the many alliances that exist to implement POSC standards. The members leverage their investments by teaming with several other companies.

There are two downsides to the this second strategy. First of all, it takes a lot of resources for a company to do it alone. Secondly, if the migration is not done in close cooperation with other companies, the final mapping may be different in details than the way the rest of the industry is doing it. For these two reasons, a third strategy is to form an "alliance" consisting of several companies - user companies and software developers. This alliance, which typically consists of from several to a score of participants, tackles a business area, with the goal of producing commercial software. Examples of such projects are IPP, WIME, RAMP, and SAVE - all of which are acronymns for groups of companies that are working together to migrate to POSC (Figure 4).

I will mention in particular a geophysical implementation. This is a database set up by the Norwegian Petroleum Directorate (NPD) that catalogs seismic and well log data in Norway and the Norwegian Sector of the North Sea. Although the data itself is not stored in the database, all the information about the data is. This includes location information for all the lines, ownership information, trade and access rights, etc. The NPD has set the goal of organizing this data. In conjunction with the POSC/CAESAR project, which extends Epicentre to platform construction, the NPD expects companies to reduce its related costs by about 30-50% (Figure 5).

Figure 5. Data Repositories: Four national data respositories have been or are being developed with support from national governments.

Followup

Please keep track of what is happening through the World Wide Web page. Also, feel free to contact me at bobbitt@posc.org with any questions.

References

POSC, 1994. - POSC Epicentre Data Model,Version 1.0. Prentice-Hall, Englewood Cliffs, New Jersey.

The following article profiles an example of a commercial software vendor's POSC implementation strategy - Geoquest's GEOFRAME.

GeoFrame: A Commercial POSC Software Integration Platform

Bertrand du Castel,
Director
Communications & Common Systems

Sam McLellan,
Director
Documentation Services
Schlumberger Austin Systems

Introduction

Operating in over 75 countries, Schlumberger is the largest provider of earth science data for the oil and gas industry. At the heart of its business strategy is the vision to leverage on latest industry standards and technology and to integrate its own seismic, drilling, measurements-while-drilling, production, and testing services to help clients increase the value of this data. This is the focus of GeoQuest. Created in 1992 from a merger of GeoQuest Systems, Inc. and Schlumberger Data Services and located in 80 offices in more than 40 countries, the GeoQuest staff of 1200 is commercialising a flexible, evolvable, and open Software Integration Platform (SIP) called the GeoFrame SIP, along with a toolkit for application developers and its own family of interpretation applications for geoscientists, achieving compliance with the Petrotechnical Open Software Corporation (POSC).

GeoFrame SIP Architecture

The GeoFrame SIP forms the backbone of a highly interactive, workstation-based, multi-discipline SIP. It is designed to support a tightly integrated suite of plug-and-play reservoir characterisation applications in five major areas: geology, geophysics, reservoir engineering, petrophysics, and project data management. When clients use the GeoFrame SIP to run their interpretation applications, they also find at their disposal a powerful set of SIP utility applications designed to load, display, and plot data; print scaled colour hardcopy; and generate data listings and reports automatically. While the applications and SIP utilities provide great depth of functionality for the various disciplines, all have a common look and feel to users for easier training and learning.

The GeoFrame SIP is an open package offering an application development environment and accompanying toolkit for clients and third parties who want to build and integrate their own applications into the GeoFrame architecture (Figure 1). Its applications, currently numbering over 55, are realising POSC's vision of a unified and expandable data model and access interface that allows for wide and consistent usage of the same data when performing complex reservoir analysis. The GeoFrame SIP features common views of data, a versatile and performant intertask communications facility allowing applications to communicate and broadcast changes, a comprehensive graphics package tailored to standard geoscience presentations, a modern Motif interface with connections to underlying bulk and parametric data, and an application control interface that enables compute-intensive applications to be chained together and run efficiently across the network. The GeoFrame SIP allows client and Schlumberger application users to interpret and share data interactively or in batch.

GeoQuest POSC Strategy and Implementation

The GeoQuest interface to POSC is Schlumberger's Austin Systems Centre (ASC) in Austin, Texas, which has dedicated a team of 10 engineers as active members of POSC since 1991 to ensure that the GeoFrame SIP

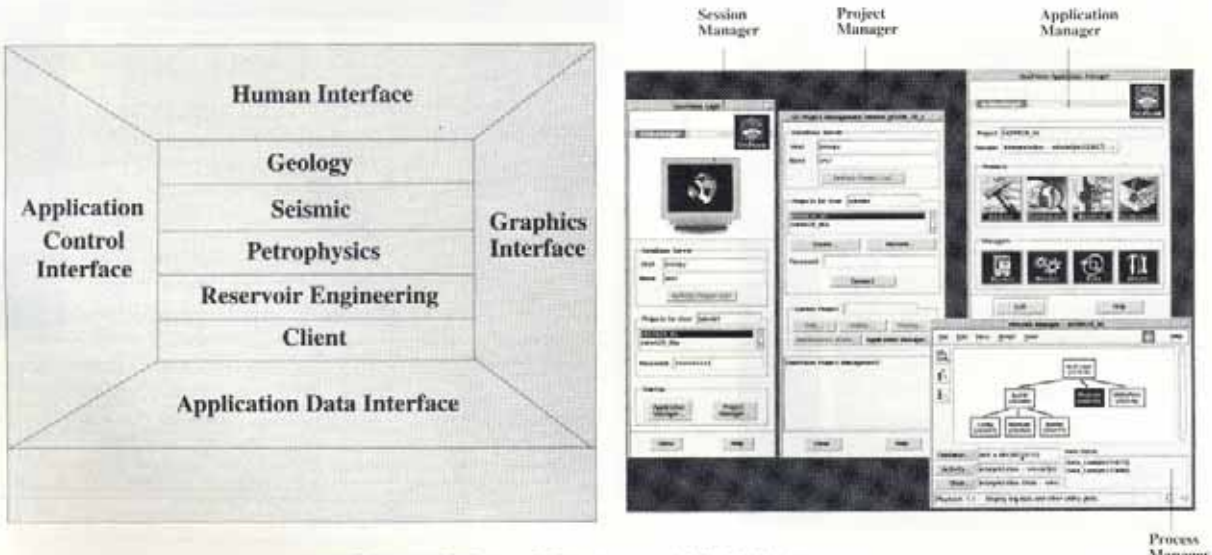


Figure 1. GeoFrame SIP Architecture & Work Environment.

meets POSC compliance in six key areas: base computing standards, user interface and graphics, data model, data access, data exchange, and work environment. Compliance in these areas is being achieved in a series of steps with each GeoFrame release.

A Standard Work Environment

Seen from the user's perspective, the GeoFrame SIP provides access to five integrated managers compliant with POSC's interactive Work Environment (Figure 1). The Session Manager controls secure access into the project databases. Users who want to point to different sets of project data or change display unit systems and the like will use the Project Manager. The Application Manager can be thought of as a desktop that allows users to view and select GeoFrame applications for use. The Process Manager allows users to run and manage applications and sequences of applications, setting the parameters and data they require, interactively or in batch. Finally, the Data Manager allows users to perform all basic data management tasks with easy-to-use interactive browsers and editors.

Common Base Standards, UI and Graphics

Underlying the GeoFrame SIP is its use of industry and POSC base standards: the X Window System (X11R5) as its network-based graphical windowing system, Motif as its window manager, the TCP/IP network protocol for local and remote computing, and Oracle as a relational database. While the GeoFrame SIP is built on Oracle and has the advantage of relational data query and access, it also employs a unique array data server for rapid access to bulk data such as seismic traces and well logs.

Support for hardcopy graphics also runs the gamut of accepted standards: CGM (V1, CGM+, and PIP/I available as of 1994; V3 and PIP/II planned in 1995; and PIP/III when completed by POSC), Raster files (TIFF and GIF available as of 1994), and Postscript (available since 1993). Augmenting the ability for applications to access and change data making up graphics presentations, the GeoFrame SIP supports a complete common language for describing, displaying, manipulating, and printing all oilfield services graphics (logs, seismics, etc). This standard separates data binding and processing from the graphics, describes the presentation of the graphics independently, and provides applications with high level access to a set of interactive editors or lower level access to libraries for creating and manipulating graphic primitives (curves, wiggles, grids), larger graphic constructs made up of groups of these primitives (tracks, cross sections, map overlays), and presentations described with the standard. The GeoFrame SIP's structured graphics approach showcases many obvious benefits. It insulates applications from knowing about the underlying data model or graphics formats, allows them to reuse and share graphics presentations, enforces a common style and interaction (object picking and feedback) with on-screen graphics, and provides automatic scaled hardcopy generation.

All hardcopy and structured graphics functionalities have been integrated with a human interface style that adheres to the POSC Style Guide (Figure 2). POSC compliant toolkits shareable by applications facilitate implementing tightly integrated inter-application communication and display. These may be thought of as a common graphical workspace or canvas that, along with a common protocol for access to it, enables applications to attach and detach themselves to the workspace, display their own data, and interact with the data of other distributed applications.

POSC Style Section ■ OK ▒ Issue □ Problem	GF
E&P Application Design Principles (Window, Menu Bar, Areas, Control, Visibility, Starting Applications)	
POSC Graphic Component (Pointing Device & Keyboard Modes, Zoom Operations, Panning)	
Selecting Graphic Entities (Selection Process, Selection Models)	
Manipulating Graphic Entities (Duplication, Direct Manipulation, Initiation, Transfer, Resize, Group, Edit)	
Drawing Graphic Entities (Behavior, Start, Draw, End, Choose)	
Cursor Control by Mouse/Keyboard (Keyboard Focus & Graphics Cursors)	

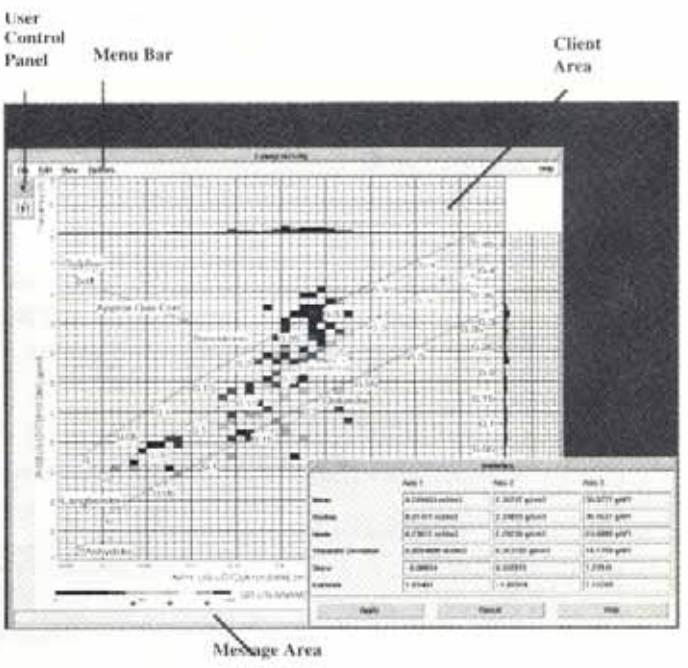


Figure 2. GeoFrame SIP Human Interface Compilance Table & Example.

Application Need OK Issue Problem	Epic	GF
Implementation Based on Client Needs		
Integrate Different Vendor Services		
Consistency of Data Descriptions		
Experimental Data		
International Well Definition		
Production Accounting		
Different Vendors for Same Data		
Data Types for New Technologies		
Support for Incomplete Data		
Share Properties		
Data Subsetting & Confidentiality		

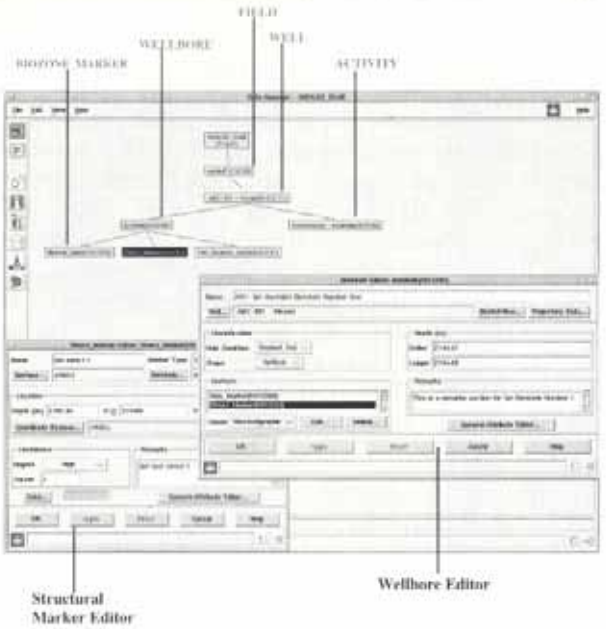


Figure 3. GeoFrame SIP Data Model Compliance Table & Data Manager Example.

Epicentre Data Model

Schlumberger continues its close involvement with the development of another key to SIP success, the POSC Epicentre Data Model, and the migration of the GeoFrame SIP to this model. From computations based on a cross-discipline sample of the Epicentre/PPDM M2 snapshot in April 1994, the GeoFrame data model implementation shows 91% concurrence to POSC's Epicentre specifications in the well domain. In particular,

- 146 Entities (e.g., Well, Logging Job)
- 141 Properties (e.g., Well_Name, Sonic Log)
- 91 Reference Entities (e.g., Well_Status)

Figure 3 shows the GeoFrame Data Manager presenting familiar Epicentre objects.

DAE Data Access

The mapping of the POSC DAE Version 1.0 specification to the upcoming GeoFrame 2.0 commercial application programming interface implementation reveals the following compliance:

- 41 general operations (daeConnectSession...)
- 17 instance operations (daeCall...)
- 24 aggregate operations (daeGetBounds...)
- 34 frame operations (daeCreateFrame...)

About 70% of DAE 1.0 now maps to the GeoFrame SIP (Figure 4). Evaluation of DAE 2.0 is underway.

Application Need OK Issue Problem	DAE	GF
Consistent Interface		
Both Parameters & Bulk Data		
Powerful E&P Queries		
Optimize Performance		
Keyed Access to Data		
Reference Multiple Data Sets		
Work with Geoscience Terminology		
Maintain Data Consistency		
Application Services		
On-going Validation of Information		
Multi-dimensional Data (n>3 included)		

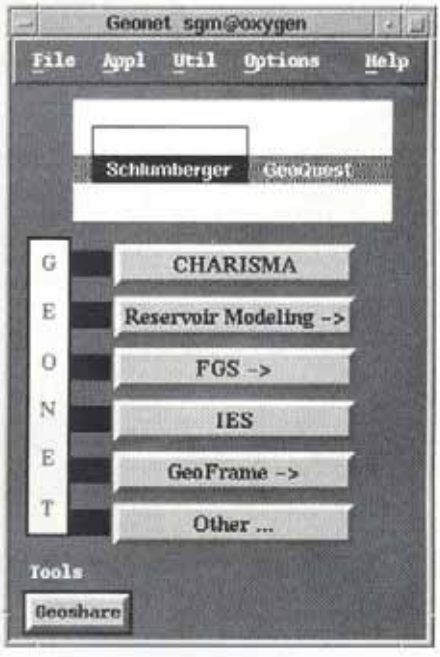


Figure 4. GeoFrame SIP Data Access Compliance Table & Data Exchange Interface Example.

Geoshare* Integration

The Geoshare standard is a means of implementing POSC's E&P data exchange specifications. It is based on a common set of agreed data types and uses the POSC-endorsed RP66 exchange format. Originally developed between Schlumberger and GeoQuest Systems before their merger, the Geoshare standard was defined in March 1992, and is actively supported by commercial products. All aspects of the Geoshare standard are now managed by the independent Geoshare Users Group (GUG) which, like other standards, is open to those with a commitment to use or improve it.

The Geoshare standard implements integration based on data communication between systems with potentially different schemas, resident data stores, and hardware architectures. Systems using the Geoshare standard exchange data through use of programs called halflinks. The halflink moves data between the local data stores, and a common data bus. The term "bus" is used to refer to data conforming to content and encoding definition standards, conventions for running the halflinks, and defined sets of acceptable physical media such as disk files and TCP/IP. A system with just one such halflink sender and receiver pair is thereby able to communicate with any other system which uses the bus. This places a potentially large number of programs supporting dedicated point-to-point data exchange and provides a practical solution to multiple application databases problems. A key integration tool for GeoQuest, the Geoshare standard (along with application launchers like Geonet*, shown in Figure 4), is currently supporting 34 geoscience software companies and 22 oil companies.

In March 1993, the GUG voted to move the Geoshare standard to the Epicentre data model. To date, the architecture and requirements are complete, with specifications in progress. As applications migrate to POSC compliant SIPs like the GeoFrame SIP, they can utilise the Geoshare implementation to share data with other data stores.

GeoFrame SIP: POSC Compliant

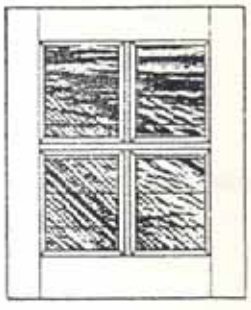
The GeoFrame SIP brings POSC compliance incrementally with each release, as illustrated above with GeoFrame 2.0. As indicated in the figures attached, there are still working issues with POSC specifications, in function and maturity. However, the GeoFrame SIP is not a pilot or prototype program but an actual commercial integration SIP already in use in numerous oil companies. It is a key for GeoQuest POSC compliance, a solution that clients are using now, and a model of how the value of POSC offerings is being made available as POSC specifications evolve.

* Mark of Schlumberger

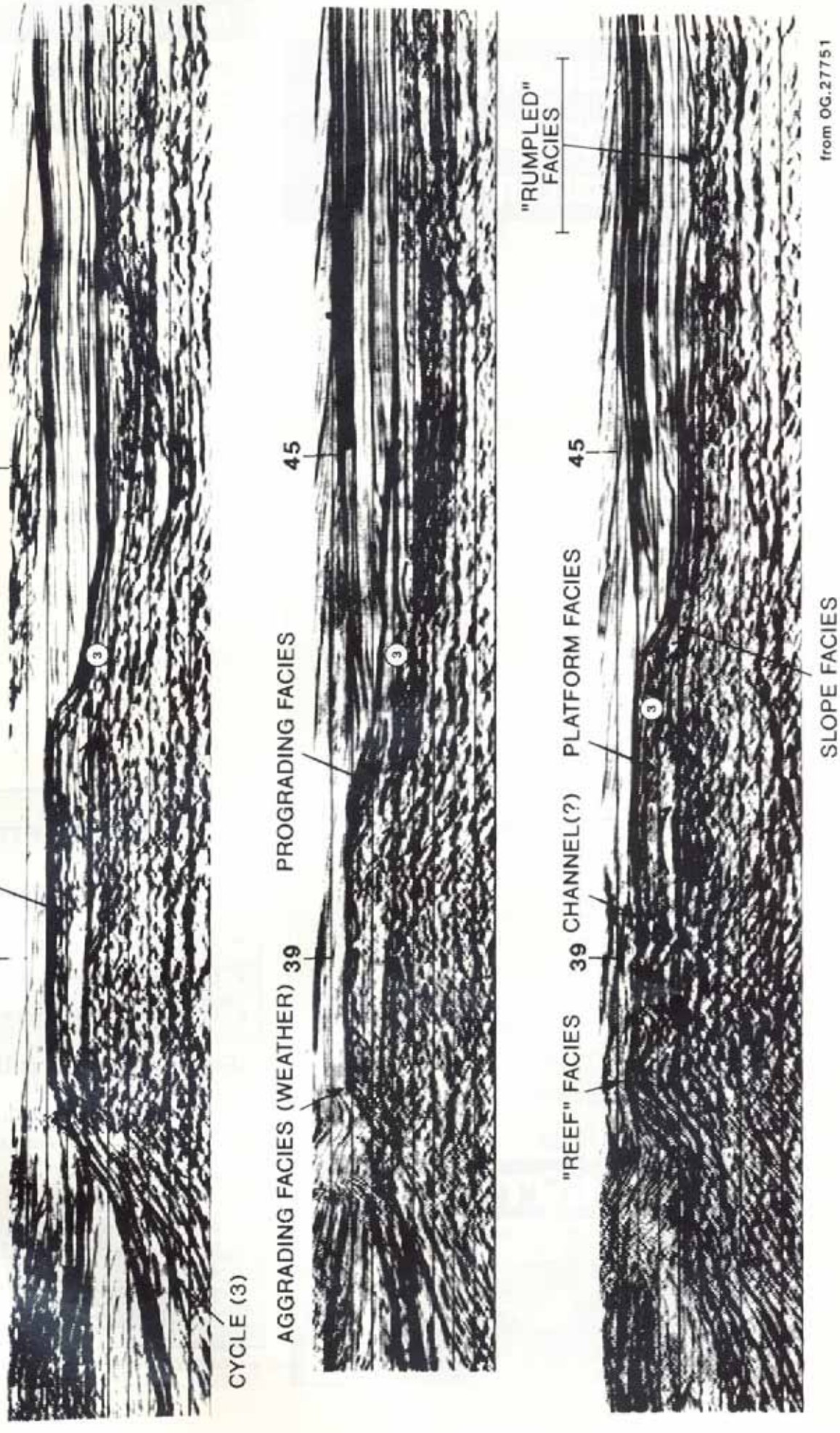
Seismic Window

With

Rob Kirk
BHP Petroleum



These lines show a Tertiary carbonate platform offshore Vietnam being drowned by distal prograding clastics.



Membership

New Members

We welcome the following new members to the Society. Their details need to be added to the relevant State Branch database:

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908 Whitehorse Road
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St Kilda VIC 3182

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Melbourne VIC 3004

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6/480 Glenferrie Road
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Benefits

- **ASEG Meetings/Conferences**
- **Exploration Geophysics (4 issues per year)**
- **Preview (6 issues per year)**

Encourage your colleagues to join.

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Otuokumpu 83500
Finland

Walter LYNN
PGS Tensor Inc
10550 Richmond Avenue
Houston TX 77072
USA

Calender of Events

March 11 1996

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1 day conference & 1 day workshop
AIG (QLD Branch), Parkroyal Hotel, Brisbane, QLD
For forther details:
Harvey Ryan
Tel: (07) 3210 0741
Fax: (07) 3210 0738

March 14-17 1996

Geophysical Society of Vietnam
40th Anniversary of Geophysical Activities in Vietnam
International Workshop & Exhibition on Geophysics
Hanoi, Vietnam
For further details
Dr Nguyen Thanh Giang
International Workshop & Exhibition on Geophysics
Lien Doan Vat Ly Dia Chat
Thanh Xuan - Dong Da - Hanoi
Tel: 544311 544 227
Fax: 84-4-542 223

March 25-29 1996

8th Australasian Remote Sensing Conference
National Convention Centre, Canberra
For further details:
ACTS
GPO Box 2200
Canberra ACT 2601
Ph: (06) 257 3299
Fax: (06) 257 3256

April 27 - May 2 1996

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International Geophysical Conference & Exposition
For further details:
John Jackson
Tel: (07) 3214 9205
Fax: (07) 3214 9122
Email: 100252.1417@compuserv.com

July 23-27 1996

Western Pacific Geophysics Meeting of the American Geophysical Union
Brisbane (see advert p 16-18)
For further details:
Mike McElhinny
Gondwana Consultants
PO Box 5
Hat Head NSW 2440
Tel: (065) 65 7604
Fax: (065) 65 7604

Sept 30 - Oct 3 1996

6th Int'l Conference on Ground Penetrating Radar
Aoba Memorial Hall, Tohoku University, Sendai, Japan
For further details:
Dr Motoyuki Sato
GPR '96 Technical Chairman
Dept of Resources Engineering, Faculty of Engineering
Tohoku University
Sendai 980-77, Japan
Tel: +81-22-222 1800 ext 4548
Fax: +81-22-222 2144
eml:GPR96@earth.tohoku.ac.jp

November 10-15, 1996

SEG Annual Meeting
Denver, USA (see advert p4)
For further details:
SEG, Tulsa USA
Fax: 0011-1-918-493 2074

February 23-27, 1997

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Fax: +61-2-9956 5154
email: GEOINS1@IBM.NET