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1/00

AEES Newsletter

Contents

PRESIDENT'S PERAMBULATIONS

The key happening since the previous newsletter was the 1999 Annual Conference in Sydney. The conference was not as well attended as previous conferences and returned a financial loss. Nevertheless, I believe it was successful in terms of technical content and level of interest, particularly at the AGM where the free-ranging discussion provided plenty of work for the Executive over the coming year. Again I would like to thank Bijan Samali for taking on the Conference organisation at such short notice. It was agreed that the 2000 conference will be held in Hobart in November but before that we have the 12WCEE in Auckland in February.

Thanks largely to the efforts of Col Lynam, the Society made a submission to the Australian Science Capability Review being conducted by the Chief Scientist expressing, in particular, concern about the loss of technical expertise in Australian earthquake hazard knowledge in depleted public services.

In spite of their espousal of the 'Smart State' philosophy, the Queensland Government has ceased funding of the seismic monitoring program in the state.

The Queensland chapter of the AEES held its first formal meeting in November 1999. Other members may be interested in forming a chapter in their own state and to assist in this, I have forwarded state membership lists to each State representative. Hammer on their doors if you want to pursue this. The distribution of members (at October 1999) is of some interest and is set out below:

New South Wales	81
Victoria	34
Queensland	31
South Australia	17
Western Australia	15
ACT	13
Tasmania	3
Northern Territory	1
Total Australia	195
Overseas (12 countries)	16
Total membership	211

There are probably many conclusions to be drawn from these numbers but the one item that struck me particularly was the low figure for Western Australia. With Meckering in mind and the previous high level of activity in this state, it seems odd that interest is now so low. Maybe apathy or lethargy has set in as hinted at by Kurt Zink in his letter to the Editor in the 2/99 Newsletter?

We received Seasons Greetings from the Society team at the Institution of Engineers, Canberra and I join with them in expressing a very Merry Christmas (belatedly) and a safe and happy New Year to you all.

Bill Boyce

AUSTRALIAN EARTHQUAKE ENGINEERING SOCIETY Conference and AGM

Sydney - 29th and 30th September 1999

Conference

Dr Bijan Samali organised and ran a most interesting and educational 2-day seminar for the disappointingly few 50-odd attendees. The last minute change of venue from Newcastle to Sydney (caused by Ian Pedersen's late minute withdrawal as organiser) didn't help but we are most grateful that Dr Samali managed to put together such an interesting and varied program and at the very last minute squeeze in a special session on the recent Turkish and Taiwanese earthquakes.

Guest speaker Bob Park from New Zealand was a late withdrawal due to ill health and we wish him a speedy recovery. One of his protegees, Professor Nigel Priestley at the University of California described his lab and their dynamic testing of a 5-storey model building. Dr Samali and Dr Denham, keynote and guest speaker respectively, gave entertaining and

thought provoking talks on the UTS shake table facility and Public-Good geoscience. Dr Denham's paper is reproduced below since it didn't make the proceedings. Topics of the other presentations were a mixture of earthquake engineering and engineering seismology, nine of the 22 papers directly related to the theme of the Newcastle earthquake, lessons learned 10 years on. Knowledge in the areas of masonry construction and earthquake ground motion modeling have apparently gained most in the last decade.

One could be forgiven for doubting that any lessons have been learned with the recent decision by the Queensland Government to cease funding basic earthquake monitoring there.

Perhaps the most poignant talk I have heard at one of our meetings was by Robert Sirasch, an engineer involved with the rescue in the Workers Club from moments after the earthquake, who spoke for the first time of his experiences and personal trauma in that situation. Essential listening for those planning to get involved in the next response effort!

Participants were treated to a tour of the impressive shake table facility at UTS and invited to participate in joint research projects.

A dozen or so members took the pre-conference Newcastle tour, we met the new Mayor of the city over lunch, and engineers such as Harold Stuart who were involved with and spoke of the response and recovery after the 1989 earthquake. The renovated Newcastle is a more attractive city today than before the earthquake which is a real tribute to them all.

The dinner venue was a great success, Sydney City viewed from a luxuriously appointed ferry cruising the inner harbour. Barbara Butler did well!

Barbara and Bijan also somehow managed to layout, print and distribute the proceedings before the conference despite the speakers (usual) tardiness in supplying papers.

Thanks to Bijan and Barbara for a very successful 1999 conference.

AGM Minutes - Russell Cuthbertson

Meeting opened at 5:10 pm.
Present: John Berthon, Bill Boyce, Barb Butler, David Catley, Russell Cuthbertson, Alton England, Gary Gibson, Colin Gurley, Steven Jaumé, Vagn Jensen, Bill Jordan, Nelson Lam, David Love, Col Lynam, Peter McBean, Kevin McCue, Michael Neville, Adrian Page, Wayne Peck, Bob Potter, Keith Simpson, Cvetan Sinadinovski, David Stewart, Javad Tabatabaei, John Wilson.

Apologies: Russell Blong, George Walker, Vaughan Wesson, Graham Hutchinson, Charles Bubb

Previous Minutes: The minutes for the 1998 AGM were accepted.

Business arising: Bill Boyce explained the reasons behind moving the 1999 conference from the originally proposed venue of Newcastle to Sydney. Bill Boyce reported that Michael Neville had provided a list of contacts in various state government departments who were involved with earthquake disaster recovery. While Michael pointed out that these people meet on a regular basis and the list is kept current Bill noted that what was being considered was a list of engineers who would be available for inspecting buildings following a damaging event. An invitation to register will appear with the next Newsletter.

Treasurer's Report: Steven Jaumé reported that the 1998 Perth Conference made almost $2400 profit (congratulations to Peter Gregson and the organising team). The Society currently has $34,825 in term deposit and a bank balance of $13,139.

President's Report: The committee has attempted to keep state representatives informed via copies of minutes and members informed via newsletter articles. Advice from AusAID to Bruce Sinclair of RedR was that Australia would not be assisting with aid for reconstruction in Turkey and hence a joint proposal from RedR and AEES for aid funds would not be successful. Mike Griffith was in Europe following the earthquake and so the Society has agreed to pay his airfares from Italy to make a report on the earthquake and its effects.
Bill noted that the existing AEES constitution is in need of revision and he proposed to draft revisions. Members will be kept informed of progress.
Bijan Samali was thanked for his efforts in organising the 1999 Annual Conference.

Newsletter Editor's Report: A third Newsletter will be distributed before year's end. Contributions to the Newsletter are always welcome (*Ed – that was the plan*).
Web site and email list report: In the absence of Vaughan Wesson, Gary Gibson reported that the AEES web site was being visited by several hundred people each week. There are still only a limited number of people who have subscribed to the AEES email listserver. Ideas for items to include in the AEES web page were solicited.

Sub-Committee Reports: Kevin McCue reported that other commitments have prevented progress on the revision of the intensity scale.
A proposal to IDNDR to investigate the occurrence of aftershocks in Australia (for emergency management information) was not successful. Kevin asked that $500 to $1000 be used to fund an initial literature survey of aftershock occurrences. This funding proposal was accepted by the meeting.

Next meeting: The meeting agreed that despite the World Conference being held in Auckland in February 2000 an AEES meeting should still be held in 2000. This should be scheduled for after the Olympics and also after University semester finished - perhaps in November. John Wilson moved and Gary Gibson seconded a motion that the 2000 AGM be held in Hobart. Organisers would include Vagn Jensen, Dick van der Molen (retiring to Hobart from Melbourne University) and Barb Butler. John Wilson also offered his assistance. The motion was carried by acclamation.

Elections: Steve Jaume intends to return to America and so did not seek re-election as Treasurer. The following positions were filled unopposed:

President - Bill Boyce
Secretary - Russell Cuthbertson
Treasurer - Colin Lynam
The state representatives for the next year will be:
NSW Michael Neville Qld Gary Huftile
Vic John Wilson Tas Vagn Jensen
ACT Kevin McCue SA Mike Griffith
WA Peter Gregson
The appointment of Peter Gregson and Gary Huftile will require their acceptance as they were not at the meeting.
The newsletter editor is Kevin McCue and the AEES Webmaster is Vaughan Wesson.
Barbara Butler will continue in the role of Secretariat.

Other Business:
There were several suggestion as to how to spend some of the society funds.
Adrian Page - Annual prizes for best student project in any field of earthquake engineering.
Vagn Jensen - sponsorship of students.
Peter Mora - Brochure to be used to raise public awareness of earthquakes and the society.
Col Lynam - Encourage students to join AEES.
Col Lynam - Survey of current and possible members regarding concerns for the future of earthquake engineering in Australia.
Following Adrian Page's suggestion, the meeting agreed we would consider involvement in a SPIRT grant which would amount to $15,000 over a period of three years.
John Wilson expressed concern over allotting $15,000 to a single project. Bill Boyce noted that this amount would be spread over three years during which time the society's funds would be increasing via registration fees and conferences.
There was discussion on what would happen if more than one application for SPIRT funding was received. Bill Boyce commented that this would be addressed at the time.
Bob Potter recommended that the society should ensure that the new loading code receives a suitable review by Australian engineers. Bill Boyce commented that he was involved on the code committee as the official AEES representative. He would ensure that the code was distributed for review.
Credit card facilities are to be organised for the payment of membership fees and for conference registration.
Kevin McCue suggested that registration fees be raised to $30. It was noted that fees for 2000 have already been set at $25. The Executive will increase fees appropriately for 2001.
Meeting closed at 6:00 pm.

The Society website/email list

Dear AEES Members,
The AEES web site is at www.aees.org.au We used an online form for registrations for the September AEES conference and this method seems to have been very successful.

We are always looking for suggestions on other things to be included such as:

- copies of the newsletter
- details about relevant up coming conferences
- details of interesting recent publications
- significant research projects in earthquake engineering (in Australia?)
- links to other relevant Web sites

What other things do *you* think could be included?
If any of our readers/members have an interest in contributing to the development of the Web site, send email to "vaughan@seis.com.au"

Cheers, Vaughan Wesson

Note:
The AEES email list is operated by the Seismology Research Centre, Melbourne. If you would like to register please notify Vaughan Wesson vaughan@seis.com.au

NUGGETS FROM THE NEWSGROUP - A REGULAR FEATURE BY CHARLES BUBB

This seems like a good thread in which to re-introduce the following article. I posted some excerpts from it a while back, and was rather bemused that it generated no discussion. It is from the latest issue of the SSA's "Seismological Research Letters", author Cinna Lomnitz of the Instituto de Geofisica, UNAM, Mexico.

The End of Earthquake Hazard

Unlike some other natural disasters such as droughts, floods, or hurricanes, earthquakes are selectively destructive to humans. Other life forms are relatively immune to earthquake damage. As we learn to diagnose and prevent earthquake disasters we may begin to reflect on the impending demise of earthquake hazard. What will happen when human societies will be as little affected by this hazard as social insects are today - a modest goal, considering our relative technological superiority over ants or bees?

In the next few decades, fundamental advances in structural design and building technology are likely to reverse the current trend toward increased vulnerability of structures to earthquakes, which has been attributed to changes in land use since the 1950's related to urbanization. Recent seismic disasters in Mexico City, the San Francisco Bay Area, and Kobe were clearly related to soft ground conditions. Thus one key advance in the control for seismic disasters will probably occur in the field of site-conditioned design of construction systems.

The vision of a society without earthquake risk may seem utopian to some. But Utopia is here already. Some structures in common use are both economical and earthquake-proof, owing to the fact-first pointed out by James N. Brune - that the effects of earthquakes are bounded. The free-surface ground acceleration remains below 2g, a theoretical inference which has been confirmed by available strong-motion

observations of earthquakes. But an acceleration of twice gravity can be handled easily by an automobile.

It might be objected that cars are unsafe as compared with homes, but this is not the fault of earthquakes. It is due to the fact that our driving habits are even more pernicious than our structural designs. The point is that our homes, our offices, our bridges, and our freeways should be made at least as earthquake-resistant as our cars.

This was but a distant dream a few decades ago, but it has become a reality on hard-ground sites throughout the world. After the 1922 Chile earthquake the Carnegie Institution of Washington issued a booklet purporting to instruct peasants in the art of reinforcing adobe construction with twigs and branches. Today in Chile as in Mexico adobe is but a distant memory. There is hardly anyone left who is old enough to remember how to make adobes. On the other hand, hazardous construction on soft ground has spread all over the industrialized world.

Norman Haskell and Frank Press discovered coupling between Rayleigh waves and P waves around 1950. The effect was first observed at the interface between water and ice, and later between soil and air. These seismologists realized that coupling represented an efficient mode of propagation of seismic energy at any interface, but as the work was done for the Air Force it was immediately classified because of its relevance to the detection of atmospheric explosions at large distances. I suspect that they realized that coupling can be just as relevant to earthquake hazard, since the coupled modes propagate efficiently along the base of soft soil layers. But the term "coupling" was dropped from the seismological literature, and eventually it was forgotten.

Coupling accounts for the monochromatic waves of finite time duration known as coda waves. A theoretical explanation was provided by Frank Press And Maurice Ewing in 1951. As the phase velocity of Rayleigh waves approaches the speed of sound in the soft layer the dispersion curve undergoes a subtle change. It develops a kink or step which has an inflection point at the coupling frequency. The coupling point matches a maximum of the group velocity.

A singularity arises when the two phase velocities are equal. Coupling spawns a new, nearly vertical group-velocity curve, where each point on the curve is an Airy phase.

In a bounded basin, Octavio Novaro and coworkers in Mexico City found that the coupled mode is locked to the interface between the soft surface layer and the underlying harder sediments, and it echoes back and forth between the lateral boundaries of the basin, thus generating a quasi-stationary wave field with prominent nodes and antinodes. As the thickness of the soft layer is usually much smaller than the wavelength, the mode radiates to the free surface, where exotic nonlinear interactions between elastic and gravity waves are generated. The response of the basin strongly depends on the geometrical shape of the soft layer.

In the case of soft ground the phase velocity equals the speed of sound in the soft layer-usually 1.5 km/s for saturated soils. A coupled mode translates as a velocity step across an array: The apparent velocity stays constant for the duration of the wave train. Diagnostic features include coherence, monochromaticity and constant phase velocity. These insights have been obtained by means of new experimental array techniques.

The Texcoco Array is a seismic array sited on extremely soft soil near Mexico City. The water content of the soil is above 90%, great enough so that conventional instruments tend to sink into the mud by their own weight. Roger Bilham designed a new strain seismograph that can be screwed into the mud by hand. This potent device has produced amazing strain records of coupled modes, including an intriguing DC component which had never been noticed before. Soft-ground seismology is a rapidly developing new branch having important connections with acoustics, nonlinear science, and the physics of colloids.

If damage on soft ground can often be attributed to coupling-a relatively unfamiliar and little-understood phenomenon-the consequences of this insight to earthquake engineering are immediate and remedial action is straight-forward. Design on soft ground must be based on the mitigation or suppression of resonance. This was only dimly realized before, since earthquake engineers assumed that the seismic signal would be brief, incoherent and random, whereas what we actually get on soft ground is a highly coherent, monochromatic signal of long duration.

The situation may be compared to what happens when a car travels over a cobbled road surface. The dominant frequency is given by the size of the cobblestones and by the speed of the vehicle. If we happen to hit a resonant frequency, the automobile is done for - unless fluid viscous damping has been installed. Likewise, in the basin of Mexico the dominant frequency of the ground is about 0.4 Hz, and this frequency happens to be in the range of the resonant frequency of buildings six to eighteen stories high. Altogether 371 buildings of this size collapsed in the 1985 earthquake.

Resonance is a well known problem in vibration engineering. The recommended method of remediation has been aptly summarized by a naval engineer, Dana Johansen: "Know the Input/Bound the Output/Mitigate the Difference." In Mexico City the input is a coherent seismic signal with a Peak response spectral acceleration of 1 g at 0.4 Hz and a duration of up to five minutes. The output has been bounded - in the 1987 version of the Mexico City building code - at a peak response spectral design acceleration of 40% g. The gap between 1 g and 40% g is the difference which needs to be mitigated.

How can this be done? Chiefly by increasing the damping and by careful testing. In the automobile industry, new models are subjected to extensive and grueling road tests - with actual machines, not computer models. On the other hand, a full-sized building is rarely subjected to destructive testing.

Reinforced concrete-frame structures have less than 5% critical damping, while cars are damped at around 23% of critical damping. When the damping is any less, a driver hits his head against the roof, while if the car is overdamped the ride is too hard. In other

words, the amount of damping is determined by the customer.

Fluid viscous dampers have been used exclusively for decades because they are sturdy and require no maintenance and because their restoring force is linear with velocity - just what we need to control resonance. Viscous dampers distributed throughout a structure can achieve the same result as base isolation at a significantly lower cost. The first high-rise building using fluid viscous dampers is now going up in Mexico City. It will be the tallest structure in Latin America, but this is beside the point. It will be safe against earthquakes. Other structures will follow suit, because the solution is economical and rational. Dampers are ideal for retrofitting, because they are much easier to install than shear walls.

When a structure is properly damped, it is prevented from oscillating wildly. It will not swing out of control, even during the strongest possible earthquake. It will not capsize as some high-rise buildings did during the 1985 Mexico earthquake. It will not go into longitudinal buckling modes as did the Hanshin Expressway in Kobe and the Cypress Freeway in Oakland. We know this from the tested performance of dampers in vibrating machinery and from the performance of damped ships in a rough sea. Engineers are not new at this game. We have been successfully dealing with the effects of coherent harmonic motion for a very long time.

In conclusion, let us be reminded that engineered structures can be routinely designed and tested against vibrations. Dampers do not seem to add substantially to the total cost because their presence encourages the Structure to lose weight. Some recent research on the effects of earthquakes on soft ground seems to suggest that an analogy between buildings and cars may not Be all that farfetched.

It is not officials we should attempt to convince. The complaint that earthquake strategy is a low priority item on the agenda of governments has been heard too often. Instead, the housing industry must offer innovative, environmentally safe dwellings to the public at a price people can afford to pay. Too many of today's structures are sitting ducks for earthquakes. As a civil engineer I realize that we are trained to look at gravity as our primary challenge in structural design. The result is frequently a rigid, fragile, top-heavy, expensive, and hazardous building. But the public will not accept earthquake risk much longer.

Though Lomnitz may be exhibiting too much hubris (or not - time will tell), it seems evident that the combination of long-term probabilistic seismic hazard assessment and advances in building design and construction offers far greater potential for the saving of lives and money than even the most perfect plausible short-term prediction methodology could.

Michael Williams
Arroyo Grande, CA USA

Charles

The AEES subscription year is from 1 Dec to 30 November. It is expensive to send each member an individual reminder that fees are due so please help us by sending your subscription for 1999/2000 to AEES (attn: Barbara Butler, Civil and Environmental Engineering Dept, Melbourne University Parkville Vic 3052) or renew through IEAust's annual subscription system by marking AEES your preferred Society. If you change address or if you know a member who is not receiving the newsletter please advise the Secretary, many newsletters are returned.

Public-Good Research in the Geosciences or the Rise and Fall of Geoscience in Australia

This article is based on a presentation made by David Denham at the AEES Conference held in Sydney on 29/30 September 1999.

This article focuses on AGSO, the National Geoscience Research Institution, the Mineral Industry, because it employs more geoscientists than any other sector, and the CRCs because they represent a major government investment in R & D activity.
During the first Howard Government significant funds were made available by the Federal Government for Geoscience R & D in Australia.

During its first week in power it decided to fund a new special-purpose building for the Australian Geological Survey Organisation, to the tune of ~$104 million. Quite remarkable, given the cost cutting environment of the day, and the almost single-minded preoccupation at that time with reducing government debt.

This was followed by a commitment to maintain the Cooperative Research Centres. In the geosciences this meant continued support from government for the Australian Geodynamics CRC, the Australian Minerals Exploration Technologies CRC, and the Landscape Evolution and Mineral Exploration CRC.

The Geodynamics CRC was particularly focused at Public-Good outcomes. The main research thrusts were on big picture geological problems. It tackled such issues as:

- How was the Australian continent put together geologically?
- What is the crustal structure of the continent?
- How did major tectonic events lead to the formation of ore bodies, zones of mineralisation and zones of weakness in the crust that may affect the occurrence of earthquakes?
- Can we determine models that assist in locating giant ore bodies?

The Geodynamics CRC also contributed to fund deep seismic traverses over several parts of the continent. The results of this work led to significant new information on the geology of Australia and the generation of new models for crustal aggregation.

The government also agreed to set up a National Seismic Imaging Resource involving AGSO and the ANU to acquire a complete land-seismic vibroseis

facility and many stand-alone remote earthquake recorders for seismic tomographic studies. The investment in capital works alone amounted to over $4M.

The first year of the first Howard government saw a confident and dynamic resources sector in Australia. In the mineral industry, for example, a record A$1.15 billion was invested in exploration during 1996/97. At the same time exports from unprocessed and processed minerals amounted to A$37 billion. This is 50% more than the value of agricultural exports, and nearly twice the value of our manufacturing exports.

The government then tackled the Native Title issue arising from the *Wik* decision of the High Court of Australia, and pushed through legislation to implement the 'Ten Point Plan', so that there would be 'Certainty' in matters relating to land use and land access.

Furthermore, Senator Parer (the then Minister for Resources) opened the new AGSO building in January 1998 and obtained $3 million extra money for AGSO in the 1998 budget for onshore research activities. The government also provided new industry R&D money (~$3 M) for World Geoscience to develop a new multi-purpose remote-sensing platform (CEREBUS).

The future looked good, however, within one year of the 2nd Howard Government, the whole thing fell apart.

AGSO was split up, downsized and demoralised. All the main mineral explorers started sacking exploration geoscientists, and in some cases pulling out of exploration altogether. Exploration budgets were slashed, and companies vanished overnight.

In the last round of CRC applications not one new Geoscience CRC bid was successful, and both the AMET and the Geodynamics CRCs will cease to exist at the end of this financial year. The new ANSIR is also critically short of funds and is struggling to operate effectively in the present environment.

So how did we get in this mess, and what can be done about it? Let us look in some detail at what went wrong and why.

Firstly AGSO

Three issues combined to reduce the effectiveness of the organisation. The first was the construction of the new building. C Northcote Parkinson recognised the dangers of Special Purpose buildings in his classic 'Parkinson's Law', published in 1958.

Parkinson argued that during a period of exciting discovery or progress there is no time to plan the perfect headquarters. The time for that comes later, when all the important work has been done. He argued that perfection of planning is a symptom of decay and that perfection of planned layout is achieved only by institutions on the point of collapse. Perfection as we know is finality, and finality leads to death.

A special purpose building freezes an institution at a particular point in time and makes it very difficult for the institution to change. He quotes as examples:

The Basilica and the Vatican, which were planned and constructed after the great days of the Papacy (Innocent III & Gregory VII) were over;
UN and League of Nations buildings (Palace of the Nations was not opened until 1937, almost in time to welcome the onslaught of World War II);
Versailles – Louis XIV's triumphs were mostly before the Palace was constructed, and it was not completed until 18th century, when his power was rapidly declining; and New Delhi which the British announced as the site for the new capital of India in 1911. By the 1940s they were gone, never to return, after occupying the continent for several hundred years.

There may be a bit of tongue in cheek in all this but right now one of the main concerns of AGSO is how to manage paying the rent on the building (~$2 M/yr.) in an accrual accounting environment. It also has to deal with laboratories that were designed for functions which are no longer carried out by AGSO. All its energies are certainly not focused on the geosciences.

The second issue was the 'Change in Administrative Orders' effected after the 1998 election.

The net result of this was to rip out the Land and Water parts of AGSO and put them in another department. This left a Resources and Hazards rump behind, and although the Resource Assessment functions, which were separated from the old BMR in the early 1990s, were returned to the fold, the Land and Water sectors are going to be one of the main growth areas for the geosciences in Australia in the foreseeable future. It really does not seem to make any sense to have these not being carried out in the National Geological Survey, particularly as the same data sets, skills and analysis techniques are used in both the Resources and Land and Water activities.

However, I do not believe that, when the new Administrative Orders were written, it was the government's intention to split-up AGSO. As the saying goes, '95% stuff-up, 5% conspiracy' – some stuff-up!

Before the election the Resource Sectors had lobbied the government for better representation at Cabinet level. Remember that Senator Parer was not in the Cabinet in the first Howard government. Essentially they were arguing that because they are so important to the export earnings of the country they should be better represented in the new Ministry. Howard obviously agreed and gave Senator Minchin, who is in the Cabinet, the responsibility for Mineral and Petroleum Resources.

The related factor was lobbying from the National Party, for all the Land and Water parts of Government. It all seemed very reasonable, after all if you are responsible for agriculture, forests and fisheries it would seem logical that you also are responsible for Land and Water research in government. Then came the tricky bit.

To implement these changes required the split-up of the old Department of Primary Industries and Energy. This involved interactions between bureaucrats who basically fought over the way this was to be done. AGSO missed-out. Land and Water went to the new Agriculture, Forestry and Fisheries

Australia (AFFA) and the rest of AGSO went to the enlarged Department of Industry, Science and Resources. The option of AFFA contracting-out AGSO services for matters land and water was rejected.

The third issue was the reduction in AGSO's budget. The last budget cut about $7.5 M from AGSO's appropriation of about $50 M. This was coupled with a Cabinet Decision that required AGSO to undertake frontier petroleum work to encourage petroleum exploration offshore with no additional money. This program needs about $11 M/yr. to carry out. Hence the need to cut ~100 staff, mostly out of the Minerals Division, because it was perceived that onshore resource development was primarily the responsibility of the States and Territories.

The combination of these three issues dealt a body blow to AGSO. It will take some time for it to, re-build and make the impact that it used to before it was split-up.

Let us now look at the **Mineral Industry**.
The Mineral Industry is the main export earner for Australia; minerals underpin wealth creation in Australia; and Australia has more of its wealth in mineral, oil and gas assets than all bar one of the top 20 wealthiest countries in the world.

Australia is a world leader in many areas of exploration, mining and minerals processing technology and research. In the present climate of global competitiveness is crucial for wealth creation that this leadership is maintained.

There is fierce competition for the exploration dollar and more importantly, with the downturn in the Asian economies there has been a drop in commodity prices and a consequent reevaluation of the economic viability of currently operating mines. Only the more cost effective will survive.

In fact commodity prices have been sliding ever since human beings mined minerals and petroleum. This is in-spite of an increased demand for minerals, increased environmental concerns and the fact that most of the easy to find deposits have already been discovered.

One of the biggest impacts of the decline in commodity prices has been in the Gold Industry, which funds more than 60% of the total exploration activity in the minerals sector. The future of gold as a commodity has been under question with the sale of gold from the national banks pushing gold prices even lower, from a high of close to US$400/oz to the level of ~US$250 in August this year. I forecast that the recent upturn in gold prices will be a short-term aberration, although it will be a welcome respite for the industry.

However, most of the major explorers have cut back their exploration staff.

Riotinto: nearly 100 of its exploration staff sacked in the last two years. The Bundoora R & D building mostly empty (another special purpose building?), exploration almost ceased after 7 round of cuts in two years. BHP: 50% cut in the exploration budget, several offices closed. Aberfoyle: company taken over and exploration staff all sacked. MIM: more than 50% cut in the exploration budget ($35M to $17M). WMC: all offices closed except Perth, ~150 people gone.

And so it goes on. The net result is that the huge corporate knowledge base which used to reside in companies like BHP and Riotinto has almost vanished. Companies like Riotinto are now buying prospects rather than exploring.

The Australian Bureau Statistics numbers tell the story. The trend estimate for the June quarter for mineral exploration expenditure fell by 10%. This was the eighth consecutive quarter to show a decline and at $181 M was 40% lower than the peak of $302 M in June 1997. No wonder that there are ~2 000 unemployed geoscientists in Perth.

The result of these changes is clearly reflected in the stock market. In March 1996 when John Howard came to power BHP was the top company listed on the Australian Stock Exchange, with a market capital of $38 billion, and companies such as CRA (4^{th}) and Western Mining (9^{th}) were also in the top 10. Now BHP is ranked number four with a market capital of $31 billion – less than in 1996, Rio Tinto has dropped to 7^{th}, and WMC has dropped out of the top 10 down to 15^{th}. The top companies are now in the Banking and Communication businesses. On the top of the heap is News Corp, followed by Telstra, NAB, BHP, the CBA, Westpac, the ANZ Bank, Riotinto, AMP and C & W Optus.

I believe that the cutbacks on exploration, on the scale we have recently witnessed are short sighted. As a nation we will continue to rely on the Resource Sector for many years to provide export earnings, and if we do not have the research underpinning these industries we will cease to be competitive as a nation. Eventually mines run out of ore and more has to be found, so the current situation is a short term fix to preserve profits for the Companies, rather than a long term plan to ensure we have a continued supply of replacement ore bodies.

Finally, **the CRCs.**
In the last round two major bids were made for new Cooperative Research Centres in the geosciences. A renewal of the Geodynamics CRC and a new 'Geophysical Exploration Technologies' CRC. Both were unsuccessful, and both for the same reason. It was not because of the quality of the science, but because there was only a low level of 'cash' support from the Minerals Industry. CRCs are currently supposed to be partnerships between universities and industry. If industry cannot, or will not contribute then there will be no CRC under the present guidelines.

It is not really surprising that, in a climate where companies are downsizing, they are unable to make long term commitments of up to seven years (the duration of a CRC). However, the net effect is that rich companies, with a secure profit flow, such as those in the pharmaceutical and communication industries, are able to raise industry contributions, and will be able to tap government funds for research, but those from industries that cannot raise cash contributions will not be successful. In other words those who can afford to do research get the rewards, those who can't don't. The rich get richer and the

poor get poorer. To get a successful new CRC up and running in the Hazard area you really have to obtain support from the construction and/or the insurance industry. At this time it is not clear to me how this can be done.

So what can we do?

The first is to lobby government on the virtues of the public purse providing money for earthquake/hazard related research. Governments now operate on Outcomes and Election Promises. Unless you can get a mention of earthquake seismology, earthquake engineering or geoscience research in the Liberal/Labor/Democrat Policy Statements it will make it very difficult to obtain a commitment for funs for these sectors.

There is huge pressure on governments to deliver high profile services to the taxpayers – basic health, education, law and order and jobs, in an environment where more money will have to be found for our defence forces, and taxation reform which may well see the rich get richer and the poor poorer.

In other words there has to be very good arguments or effective powers of persuasion to attract government funding.

Universities are also being squeezed and it may be that the earthquake functions get dropped off when funds are reduced. We have seen this to some extent at the ANU, at the University of Tasmania, and the University of Central Queensland. Perhaps the option of rationalising Australian research in seismology should be examined so that in the future all or most of the teaching and research is carried out at two or three institutions.

After all, the astronomers seem to be able to obtain funding for their work and their studies are as basic and non-applied as you can get, so why not seismologists.

Governments respond to pressure and that means effective lobbying. Somehow or other, if we really believe that there is a good case for more funding in the Earthquake Hazard sector then this has to be articulated and the arguments presented across as large a number of avenues as possible.

For example there is a "Science Meets Parliament" day at Parliament House on 24 November this year. Organised by FASTs (the Federation of Australian Science Technology Societies), it will involve about 150 scientists and technologists. Can the AEES be represented at the meeting? This is an excellent opportunity to present Science to Government.

The second proposal to be considered is to make a submission to the 'Australian Science Capability Review' being undertaken by Dr Robin Batterham, the Chief Government Scientist. Here the aim would probably be to try and encourage the Government to fund more basic research, and perhaps identify hazards as an area that needs expanding.

We clearly need a balance between the applied research thrusts to attack problems such as dryland salinity and the basic research carried out by really bright people on whatever they want to work on. My view is that at present the balance is too far in the applied direction and that the current guidelines for CRCs need to be changed to address this issue.

Earthquakes in Australia -1999

Just when the Tennant Creek NT sequence seemed to have petered out the earthquakes returned in style. Otherwise the last 6 months in Australia were very quiet even as destructive earthquakes wreaked havoc abroad. This extract is from the AGSO database which includes data from Primary Industries and Resources SA, The Seismology Research Centre Victoria and Universities of Tasmania and Queensland.

DD	UTC	Lat	Long	ML	Place
April					
01	223942	15.98	120.92	3.1	Broome 260 km NNW
02	63649.6	19.83	133.94	3.1	Tennant Creek NT
04	94824.6	12.37	128.87	3.2	Darwin 214 km W
10	222754	19.62	124.75	3.2	Fitzroy Cr, 183 km SSW
11	204111.	19.89	134.12	3.0	Tennant Creek NT
15	45552	19.79	134.04	5.1	Felt in Tennant Creek NT and White Devil Mine (50 km W of Tennant Creek).
16	105121	37.38	145.98	3.1	Lake Mountain, Vic
18	214314	13.68	122.77	3.2	Scott Reef, 107 km ENE
26	211436	29.82	151.27	3.3	Tingha NSW Felt
26	212656	29.80	151.26	3.2	Tingha NSW
May					
01	181155	19.83	134.05	4.0	Felt Tennant Creek NT
02	155915	20.82	116.??	3.2	Near Dampier WA
10	100225	19.75	134.02	4.6	Tennant Creek NT
19	233121	13.73	127.88	3.0	200 km North of Wyndham WA
25	4421.4	30.21	150.17	3.1	Boggabri NSW
29	193943	19.81	133.86	3.8	Tennant Creek NT
31	191538	25.85	140.13	3.1	Near Haddon Corner Qld
June					
18	100411	19.79	133.80	3.5	Tennant Creek NT
23	55011.3	35.13	143.72	3.1	Moulamein NSW
25	3611.3	22.85	113.91	4.0	100 km south of Exmouth, WA. Felt at Bullara and Ningaloo Stations, and at Coral Bay.
July					
13	14248.2	34.28	148.96	3.1	Felt Frogmore NSW
22	192129.	19.71	133.80	3.5	Tennant Creek NT
27	54828.0	13.71	127.86	3.0	Joseph Bonaparte Gulf WA
August					
06	3334.1	31.87	138.37	3.0	Hawker SA. Felt
11	44317.8	14.52	128.84	3.0	Joseph Bonaparte Gulf WA
14	124550	25.95	130.72	3.6	Uluru area NT
18	110155	33.28	138.48	4.3	Felt Jamestown SA.
25	122308	24.34	112.57	3.0	Indian Ocean, near Cape Cuvier, WA
September					
02	1627.4	32.33	138.40	3.5	Felt Carrieton SA
06	83705.7	31.83	138.45	3.2	Hawker SA. Felt
11	194711	39.52	144.89	3.0	BASS STRAIT
25	112421	12.11	122.56	3.5	Ashmore Reef WA

CLEARANCE OFFER ON CONFERENCE PROCEEDINGS

Barbara Butler has more copies of our early conference proceedings than she can store. We can't sell them so will give them away! Proceedings are yours for the price of postage: fax: 03 9348 1524 or b.butler@eng.unimelb.edu.au

Letters to the Editor:

1st October 1999

The Dilemma of Sigma

I am glad that other people admit they have a problem with knowing the *correct* way to handle the *sigma* part of the attenuation function in a probabilistic seismic hazard study. I refer to Charles Bubb's article in AEES Newsletter 2/99 on page 2 and 3. Perhaps this may lead to a better understanding of the position Gaull & Michael-Leiba (1987) {and subsequently Gaull, Michael-leiba and Rynn (1990)} faced when they used the Cornell-McGuire method in Australia.

According to Steven Jaume in the *Nuggets* article mentioned above, he and the late Malcolm Somerville, deemed that the sigma used in the *previous study* (I assume they mean our 1990 paper) was too low. However, recent research discussed in the *Nuggets* article, implies that not only most probabilistic seismic hazard calculations handle the ground motion uncertainties incorrectly, but they also *overestimate* the ground motion (at least for the long term events).

This is extraordinary timing, as Gaull and Kelsey (1999) have just completed statistically comparing the historical intensity records at 32 Australian cities with the corresponding results from Gaull, Michael-Leiba and Rynn (1990). They showed that the backwards extrapolation of the mean/median intensity return periods obtained by Gaull and others (1990) for the same localities, fell within the 95% confidence interval derived from the regression of these historical data, showing that their modelled results fit the intensity data.

Gaull and Kelsey (1999) also suggest that the relatively low allowance for scatter in the attenuation function used by Gaull and others (1990) compensated for the otherwise conservative mean curves derived from isoseismal contours. To understand more about this statement, the reader is directed to our 1999 paper. I'm sure the editor would not be pleased if I reiterated these details here. Please contact me through brian@netserv.net.au if you would like a copy of this paper, or would like to discuss this topic further.

References:

Gaull B.A. and Michael-Leiba M. O. (1987) - Probabilistic earthquake risk maps of southwest Western Australia. BMR Journal of Australian Geology and Geophysics, 10, 145-151.

Gaull B.A., Michael-Leiba M.O. & Rynn J.M.W. (1990) - Probabilistic earthquake risk maps of Australia. Australian Journal of Earth Sciences, 37, 169-187.

Gaull B.A. and Kelsey P. (1999) - Historical felt intensities as a guide to earthquake hazard. Australian Journal of Earth Sciences, 46, 365-376.

The Turkey Earthquake

(article forwarded by Ken Granger – AGSO)

From: Project Coordinators <team@geohaz.org>
To: ghi-forum@lists.Stanford.EDU
Subject: Earthquake in Turkey
Sender: owner-ghi-forum@lists.Stanford.EDU

Dear Project Participants,

First of all, we would like to extend our most sincere condolences to the people of Turkey affected by the recent seismic activity in that region. We hope the people and cities affected are able to recover as quickly as possible from this terrible loss.

Secondly, we would like to share with you a press release prepared by GeoHazards International (GHI) addressing the reality of earthquake risk worldwide. Tragedies such as those witnessed in Turkey, Mexico, India or Colombia these past few months remind us of the fact that, unless immediate and proper action is taken, many other communities are subject to a similar, if not worse, fate. This being the case, GHI has prepared the press release included below, based partly on the "Understanding Urban Seismic Risk around the World" project. We encourage you to read over this press release and use it in your community (with any necessary modifications) for any purpose you may see fit.

Please note this press release includes a brief summary of the seismic code enforcement and emergency response planning data submitted by city representatives in the "Understanding " Project. We included this information because we felt that this data was very important in identifying part of the problem of rising urban earthquake risk.

Because we did not have your permission, we did not release specific information on individual cities; this information was compiled in a general manner and only the final statistics are presented in the press release. A supplemental data sheet will be forwarded to you in a subsequent message so that you may examine the basis of these statistics more carefully.

Some time ago, member city co-representative of San Salvador, Julian Bommer, helped organize a Radius Press Launch in San Salvador, El Salvador. The Press Launch used San Salvador's participation in the "Understanding" Project to prompt a discussion on San Salvador's earthquake risk and, thus, help inform the newly elected city officials. One of the goals was to inform these city authorities so that, hopefully, they would begin to act on mitigating their city's risk. Throughout the project, we have encouraged city representatives to undertake similar efforts, if possible, in their cities. The included press release is another example of the type of initiative that may be carried out by yourself in your city. If you feel it is

something that can be used to raise awareness in your city, modify it as you wish and feel free to use it to do so.

It is truly disheartening that tragedies such as the recent earthquake in Turkey are what focus the attention of the global community on issues such as seismic safety. Let's hope that the lives lost in this tragedy, and countless others in the past, do not continue to be in vain. Let's try to learn from these experiences, educate others, focus their attention on the cities with the greatest risk and make sure these disasters are not repeated elsewhere.

Sincerely,
The Project Coordinators

** PRESS RELEASE -- AUGUST 26, 1999 **

Izmit: a disaster waiting to happen in many Third World cities.

In developing countries, nine out of 10 earthquake-threatened cities are no better prepared to survive a major earthquake than Izmit, Turkey.

That is the conclusion of a just-completed survey of earthquake experts in 20 cities around the world commissioned by the United Nations and conducted by GeoHazards International (GHI), a Palo Alto-based nonprofit organization established to reduce death and suffering caused by earthquakes in the world's most vulnerable communities.

The 7.4 magnitude quake that struck western Turkey on August 17 killed at least 12,000 people and left 200,000 homeless.

"When a passenger airliner crashes, at the same time that people are tending to victims, others are inspecting the remainder of the fleet," says GHI President Brian E. Tucker. "Sometimes the fleet is grounded until the causes of the disaster are identified and remedied. Here the 'fleet' is the world's large cities built near faults capable of generating large earthquakes. We should inspect these cities for the conditions that existed at Izmit and fix the problems, the easiest and deadliest first."

According to Tucker, the results of the GHI survey are consistent with other recent assessments of urban earthquake risk in developing countries. The results also imply that comparable disasters will certainly occur in other cities around the world unless preventative action is taken. Furthermore, the studies make it clear that shortsightedness and lack of information, rather than cost, are the major barriers to improved seismic safety, Tucker adds.

"Few people realize how affordable earthquake safety measures are," says Amod Dixit, executive director of the National Society of Earthquake Technology – Nepal (NSET), which has been working with GHI since 1993 on improving Kathmandu's earthquake safety. "Our work has shown that building safe structures in Nepal increases construction costs by less than 3 percent in most cases, and significant increases in safety can be achieved at virtually no additional cost."

Haresh Shah, professor emeritus of Stanford's Civil Engineering Department and a member of the Board of Trustees of GHI, uses the case of Nepal, which is implementing an earthquake risk-management action plan and is poised to adopt its first-ever seismic building code, as an illustration that the devastating losses experienced in the Turkish earthquake are not necessary.

"If existing methods of emergency response planning, urban planning, retrofitting of existing structures and construction of new buildings are aggressively applied, the magnitude of the impending tragedy could be greatly reduced," Shah says. "Thousands of deaths can be avoided."

The GHI survey – undertaken as part of a United Nations seismic safety project – interviewed specialists in eight Asian, six Latin American, four European and two African cities about their city's earthquake risk and risk management practices. It found that three-quarters of the cities have building codes, but less than half enforce their code.

Further, only half of the 20 cities had even a minimal emergency response capability, while even fewer had both an emergency response plan and regular drills or actual experience using the plan. Only one city in 10 reported a good, well-enforced building code and a good, well-rehearsed emergency response plan.

According to Tucker, cities in developing countries are at particular risk of earthquakes, and that risk is increasing. In this century, four out of every five deaths caused by earthquakes occurred in developing countries. Of the people living in earthquake-threatened cities in 1950, two out of every three were in developing countries. In the year 2000, nine out of every 10 will be in developing countries.

The 1988 Armenian earthquake and the 1989 Loma Prieta earthquake in Northern California were nearly equivalent in their magnitudes and in the number of people in the affected regions, but the results were far different – 63 people died in California while at least 25,000 died in Armenia.

Three years ago, GHI organized a NATO Workshop in Almaty, Kazakhstan. At that time the experts who attended the meeting determined that half of the six million people living in the capital cities of the five Central Asian Republics occupied buildings that were extremely vulnerable to collapse during earthquakes. They estimated that a repeat of large historical earthquakes could produce human death tolls ranging from 30,000 to 135,000 per event and seriously injure between 120,000 to 540,000 people.

Last year, a collaborative study between GHI and Nepalese earthquake experts concluded that the next major earthquake near Kathmandu could kill 40,000 people, seriously injure 100,000 and leave even more homeless.

GHI's Carlos Villacís, working with leading Latin American earthquake experts, has come up with similar estimates for Tijuana, Mexico, Antofagasta, Chile and Guayaquil, Ecuador as a result of the UN project.

In the event of a large quake, they have calculated that Tijuana could suffer 18,000 deaths and 37,000 serious injuries; Antofagasta could sustain 3,000 deaths and 7,000 serious injuries; and Guayaquil could have 26,000 deaths and 53,000 serious injuries.

"It is important to realize that even the most well-drilled emergency response team, using the best emergency response plan, would have been overwhelmed with the situation – some 40,000 buried souls ! – that faced the authorities in Turkey," said Shirley Mattingly, a GHI collaborator and former regional director of the Federal Emergency Management Agency.

"There is no single *silver bullet* in the earthquake preparedness business. Threatened communities must have good and well-enforced building codes, land use plans, and emergency response plans, as well as informed leaders and an aware public that is intolerant of corruption."

Athens earthquake

On September 7th, an earthquake of magnitude 5.9 hit the northern part of Athens and killed at least 75 people, mainly form the collapse of a few industrial buildings and multistorey houses defectively built or improperly repaired after the 1981 earthquake or a fire. Most of these were built on loose material (torrent banks, etc.).

In the centre of Athens accelarations of the order of 0.5g were observed.

Aftershocks of up to 4.7 magnitude were observed. This shock is relatively small for Greece, where earthquakes with magnitude 6-6.5 are not unusual. This death toll is extremely high and unusual for Greece, where the average death toll is about 10 people per year, and was exceeded only by the 1953 Ionian Island earthquakes (Ms=7.2).

The area of Athens is usually free of strong earthquakes, although archaeological evidence indicates traces of strong shocks in the Parthenon and other monuments between 400BC and 1200AD.

No surface rupture was observed, nor was the shock associated with any previously mapped fault. Local topography, however, damage distribution and information from the distribution of aftershocks is likely to indicate that the fault was probably normal, bounding the Parnis Mountain to the south.

The seismogenic zone is estimated to about 15km long.

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stiros@upatras.gr

Studying earthquakes can be dangerous: - The Hector Mine earthquake and the Lavic Lake surface rupture

The entire fault rupture of the Hector Mine earthquake appears to be contained entirely within the Marine Corp Air Ground Combat Center located in 29 Palms. PLEASE do not head out to the Combat Center to view the surface rupture without coordinating with the USGS. Over the next several weeks, the Marines will be continuing with their previously scheduled live-fire exercises. Moreover, the sectors of the base that contain the major ground rupture are littered with unexploded ordnance. Only qualified personnel are authorised to enter this area for SAFETY reasons.

We have had reports that some people have entered base on their own. This not only imperils the trespasser, but could also jeopardise the wonderful cooperation that we have received from the Marines. The Marines have officially requested that Karl Gross of the USGS be the sole point of contact for all requests for access to the base. This includes overflights as the airspace above the base is restricted.

If you are interested in conducting scientific research on the base, you must work through Karl Gross, who will be coordinating with the Scientist-in-charge for southern California, Lucy Jones. We will try to accommodate all reasonable requests. Karl can be reached at 29 Palms at 760/830-7448.

The Marines have been extremely gracious and have facilitated nearly all of our operations so far. We expect that legitimate scientific experiments will be facilitated. Your cooperation is greatly appreciated.

Dr. Lucile M. Jones
Scientist-in-charge for Southern California
Western Earthquake Hazards Team
U. S. Geological Survey
525 South Wilson Avenue
Pasadena, CA 91106
phone: 626/583-7817 fax: 626/583-7827

AEES Q'ld Chapter – Col Lynam

Committee (1999)
Chairman: W. Boyce, Secretary: C Lynam Qld Representative: C.Lynam Committee: R.Cuthbertson
Incoming Committee (2000)
Chairman: Gary Huftile, Secretary: Col Lynam,
Immediate Past Chair: Bill Boyce,
Committee: Rus Cuthbertson
Represesentatives on Committees/ Panels
Australian President AEES (1999) W. Boyce:
National Secretary AEES: R. Cuthbertson,
National Treasurer AEES: C Lynam

Technical & Social Activities: Business meetings were held jointly during the year with the National Executive Committee, as the Qld Chapter committee held dual positions during 1999. Local issues raised included the design of a national survey of members (from the IEAust 1998 survey) on the practice of Earthquake Engineering and Seismology. Local contact was made with the Geological Society (Qld), Geomechanics Society and the Geosciences Council of Australia. A Qld AEES members list was established .

Activities: A joint meeting with the GSA was arranged but was cancelled by them. The Inaugural seminar of the Qld Chapter was held in November, with invited speakers Professor David Thambiratnam (QUT) and Dr Steve Jaume' speaking on structural engineering and earthquake forecasting topics. The Annual General Meeting preceeded this seminar, with

the first "elected" committee emplaced and discussion on potential seminars and activities. Seminars will be held quarterly.

Australian Solid Earth Simulation Facility To Be Established – Peter Mora

A parallel computational facility called The Australian Solid Earth Simulator (ASES) has been funded by the Australian Federal government and key Australian institutions involved in ACES (University of Queensland, University of Western Australia and CSIRO). It is a major boost to the ACES international cooperation and visitor's program.

This facility will have 2 nodes. The main one at QUAKES will serve Australian researchers in ACES plus overseas visitors participating in the ACES Visitor's Program. A smaller clone parallel machine with approx 25% the capacity of the main facility will be housed in Western Australia to serve the needs of the WA groups in ACES.

The funding is for $AUS1.5 million total. I anticipate the main facility will consist of approximately a 50 GFlops parallel computer which will dedicated to simulations of solid earth phenomena and particularly, earthquake phenomena. I believe this will serve the ACES cooperative work well, especially since it is managed locally at QUAKES and is a dedicated machine for the Australian ACES participants and ACES visitors.

This will greatly enhance the ACES program, and particularly, collaborative work involving researchers participating in the ACES Visitors Program.

For information about the ACES Visitors Program which commences in 2000, please contact the International Science Board Member for your country.

Australia: mora@earthsciences.uq.edu.au (Peter Mora)
China: xcyin@public.bta.net.cn (Xiang-chu Yin)
Japan: matsuura@geoph.s.u-tokyo.ac.jp (Mitsuhiro Matsu'ura)
USA: henyey@usc.edu (Tom Henyey)

I am looking forward to seeing you at the next ACES workshop in Japan, or in Brisbane during 2000 which is the first year of the ACES Visitors Program.

Hokudan International Symposium and School on Active Faulting in Japan

The Hokudan international symposium and school on active faulting in Japan, January 2000.

Takashi Nakata and Koji Okumura, Operational Committee and Daniela Pantosti and Alan Hull, Organizing Committee.

* Contact Ed for more details if you are interested

FORTHCOMING CONFERENCES

2000, 30 Jan - 4 Feb, Auckland New Zealand. 12th WCEE/PCEE.

NEW (&OLD) BOOKS / REPORTS

Awesome Forces. Ed Geoff Hicks and Hamish Campbell. Te Papa Press Wellington NZ. RRP $NZ29.95 (Great photos covering earthquakes to climate change with large IGNS contribution – a good read)

Perils of a Restless Planet. Ernest Zebrowski jnr. Cambridge Uni Press. RRP $29.95 (Will both infuriate and educate you, an engineering and philosophical viewpoint on past disasters)

Australian Seismological Report - 1996 AGSO Sales Centre ph: 02 6249 9519, fax: 02 6249 9982

Acceptable Risks for Major Infrastructure. Eds P Heinrichs and R Fell, Balkema 1995. Proceedings of the Seminar on Acceptable Risks for Extreme Events in the Planning and Design of Major Infrastructure. Sydney NSW Australia, 26 - 27 April 1994.

Report on the January 17, 1995 Great Hyogo-Ken Nambu (Kobe) Earthquake. Lam Pham & M Griffith. CSIRO DBCE 95/175(M).

Isoseismal Atlas of Australian Earthquakes - Part 3 AGSO Record 1995/44, $50 + pp. AGSO Sales Centre phone: 06 249 9519, fax: 06 249 9982

Earthquakes and Geological Discovery by Bruce Bolt. W H Freeman and Co., 1993.

Risks and Realities, Centre for Advanced Engineering University of Canterbury, Christchurch New Zealand. This book mainly presents the results of an investigation into the vulnerability of lifelines serving metropolitan Christchurch.

Seismogenic and tsunamigenic processes in shallow subduction zones, eds. J. Sauber and R. Dmowska, Birkhauser Basel, 1999. (reprinted from a recent issue of Pure and Applied Geophysics). US$44.50.

WCEE 2000
AUCKLAND NEW ZEALAND

Please Note: The New Zealand National Society for Earthquake Engineering will host the World Conference on Earthquake Engineering in Auckland 30 January - 4 February 2000.
Note: Registration forms available from Editor