



Department of Employment, Education and Training
Australian Research Council

Application for Initial Support in 1989

When completing this form the applicant must include the "Advice and Instructions to Applicants" document.

Do not attach any papers to the front of this form. Applications are to be typed.

Applications are to be lodged with the:

Director
Research Grants Section
Research Policy and Grants Branch
Department of Employment, Education and Training
PO Box 876
WODEN ACT 2606

The closing date for applications is 1 April 1989.

1. Institution to administer grant:

University of Wollongong

2. Project title:

Provide a project title that is clear, brief, precise and informative to readers outside your field.
(Up to four lines; do not hyphenate words at the end of the line. Maximum of 90 characters per line.)

Vulnerability and resilience in Australian telecommunications

3a. Total funds for 1989 requested in this application:
(Whole dollars only; total figure might be nil or zero)

3 1 1 2 7

3b. Instructions for coding:

Discipline

Category

National interest

7 3 4

3c. Do you wish this application to be considered for special consideration? Yes ☐ No ☒

4. Chief Investigator(s) - see instructions

a. Title, initials and surname (eg. Prof, A/Prof, Dr)	Dr B Martin		
b. Full address	Department of Science and Technology Studies University of Wollongong PO Box 1144, Wollongong NSW 2500		
	Telephone (042) 270763 Telex 29022	Telephone: Telex:	
c. Appointment held	Lecturer		
d. Name of Dept/School/Other (please indicate which)	Department of Science and Technology Studies		
e. Year of birth	1947		
f. Sex	Male <input checked="" type="checkbox"/> Female <input type="checkbox"/>	Male <input type="checkbox"/> Female <input type="checkbox"/>	Male <input type="checkbox"/> Female <input type="checkbox"/>
g. Academic qualifications (indicate conferring institutions and dates)	B.A., Rice, 1969 Ph.D., Sydney, 1976		
h. Average days per month to be devoted to the project	6		

5. Support

Are you also applying for 1989 support from

NH & MRC ☐

NERDDC ☐

Other ☐

If you have ticked one of the boxes state the project title and the amount requested in Section 16 and 17.

6. Work experiments

	Yes	No
Does the work proposed involve human or animal experimentation?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Does the work proposed involve experiments in which there is preparation or use of recombinant nucleic acids constructed <i>in vitro</i> from sources which do not ordinarily recombine genetic information?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Does the work proposed involve the use of ionising radiation?	<input type="checkbox"/>	<input checked="" type="checkbox"/>

If you have answered "Yes" to any of the above questions please sign the additional certification in Section 18.

7. Chief Investigator information

For each Chief Investigator detail the following:

	1.	2.	3.
a. Indicate any anticipated period of absence from institution during the course of the project including OSP.			
b. What other major research programs are being undertaken or supervised by the Chief Investigator(s)?	Knowledge and power in scientific controversy		

Other Participants

8. Provide details of the Associate Investigators: List names, organisation, qualifications, date conferred and conferring institutions. Indicate involvement in the project (average days/month). Certification required, see Section 18	
9. What technical and other staff (other than those requested) will be available to assist with this project? Indicate the involvement in the project (average days/month).	
10. Will there be any research students working on the project? If so, state the number, the qualifications being sought and type of support.	

11. Commencement/Completion date of project

Has the project started? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	If no, when will it start? 1 / 1 / 89	What is the probable duration of need for support? 2 years	What is the estimated total time required to complete this project? 2 years
---	--	---	--

12. Cooperation of other organisations

Do you require the cooperation or assistance of any other organisation? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	If yes, has the head of that organisation agreed formally in writing? Yes <input type="checkbox"/> No <input type="checkbox"/>
Attach a separate sheet of paper detailing the nature of this cooperation or assistance.	

13. Interviews

Will you be available for interview if required? (See instructions for dates)	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Uncertain <input type="checkbox"/>
Note: An interview is frequently used in the assessment of a proposal, however, it does not indicate or influence the progress or likelihood of success of the proposal.	

14. Budget Information

Refer to the document 'Advice and Instruction to Applicants' for the completion of the budget information below.

Surname of 1st Chief Investigator				File number			
Martin							
Detailed budget items	Priority for Year 1	Amount requested			Office use only		
		Year 1	Year 2	Year 3			
Salary, Research Associate level 1, \$24,847 + 18% level 2, \$25,548 + 18%	1	29,319	30,147				
Travel for both the Chief Investigator and Research Associate	2						
2 trips each to Melbourne (plane) \$342 + \$50 per day, 4 days		1084	1084				
2 trips each to Canberra (bus) \$50 + \$30 per day, 3 days		280	280				
12 trips each to Sydney (train) \$12		144	144				
Other: postage, photocopying, telephone	3	300	300				
Total		31,127	31,955				

Financial Summary Support requested	Personnel \$	Equipment \$	Maintenance \$	Travel \$	Vessel \$	Other \$	Total \$
1989	29,319			1508		300	31,127
1990	30,147			1508		300	31,955

Office use only

		Institution	

15. Summary of project

In the space provided below, supply a seven line summary of this project indicating why it is of significance. The summary of the project is to be no more than seven lines and to be single spaced. Use underlining, capital letters and any other emphasis only where required by convention eg. underline species names.
Please follow the example layout below for your summary.

Office use only

Project title:

Vulnerability and resilience in Australian telecommunications

Summary:

Australian telecommunications are subject to a range of threats for which there is little direct planning. These include military attack, natural disaster, sabotage and interruption of imports. An analysis of how Australian telecommunications would fare in the face of such threats will reveal much about the dynamics of technology in the communications sector and in the related computer industry. It will also suggest policy options for increasing the resilience of the technological systems involved.

Keywords

Give up to five keywords to describe the subject area of proposal

vulnerability

resilience

telecommunications

communications

:

Institution

University of Wollongong

1st Chief Investigator

Martin

Total support

16. List separately the support received, requested or to be requested for this project from your own organisation and all other sources.

Name of organisation	1986 \$	1987 \$	1988 \$	Requested 1989

17. List separately all other projects for which you have received support from your own organisation and other grant giving schemes including ARC.

Name of organisation	1986 \$	1987 \$	1988 \$	Requested 1989
ARCS, Vulnerability of steel industry		10,000	10,000	
U. Wollongong, Fluoridation	870	1000		
U. Wollongong, Electromagnetic pulse			1300	

18. Certification - to be signed by all applicants

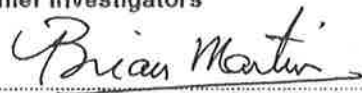
I/We understand and agree that:

- research which involves human or animal experimentation must be carried out in accordance with the guidelines laid down in the NH & MCR code of practice;
- research which involves the use of recombinant nucleic acids constructed *in vitro* from sources which do not ordinarily recombine genetic information must be carried out in accordance with the guidelines laid down by the Recombinant DNA Monitoring Committee;
- research which involves the use of ionising radiation must have the risks involved assessed by a recognised Ethics, Safety or Bio-safety Committee, personnel must be trained and hold a current licence, and;
- a certificate of compliance with the appropriate guidelines must be received by the Committee from a recognised Ethics, Safety or Bio-safety Committee before payment of any proposed grant can be made.

I/We declare that all persons listed as Associate Investigators have agreed to take part in the proposed research.

Signature of Chief Investigators

1.



(Signature)

10 / 3 / 88

(Date)

2.

.....

(Signature)

/ /

(Date)

3.

.....

(Signature)

/ /

(Date)

Certification by Head of Department

- I certify that the project can be accommodated within the general facilities in my Department, that sufficient working and office space is available for any proposed additional staff. I am prepared to have the project carried out in my Department under the circumstances set out by the applicant;
- I have noted the amount of time which the investigators will be devoting to the project and certify that it is appropriate to existing workloads.

Note: A confidential statement may be forwarded to the Committee if thought advisable. Refer to the 'Advice and Instructions to Applicants'.

.....

(Signature)

/ /

(Date)

Certification by Head (or Nominee) of Organisation/Institution

- I certify that the project is acceptable to the organisation under the terms and conditions set out in the Conditions of Award and Advice and Instructions to Applicants and that salaries quoted for personnel are in accordance with practice at this organisation;
- I certify that this project is not a specific component of this organisation's budget;

.....

(Signature)

/ /

(Date)

Note: All certificates must be signed.

20. Aims, research plan, justification of budget, and relevant publications

To answer this question fully refer to the document 'Advice and Instructions to Applicants' so that you can cover the points specifically made in it, especially in relation to policy and priority information and in detailed justification of the budget proposal.

Use the following headings to detail your answer:

- Aims
- Research Plan
- Justification of Budget
- Relevant publications

Applicants should specify clearly and justify the expected duration of the project.

If you have answered Yes to Section 3c (program grant) attach a supporting statement and list all associated projects. Include an extended budget using a duplicate page 3 for years 4, 5 and 6. (See instructions) Attach additional pages if there is insufficient space.

Aims

The vulnerability of Australia's telephone network to sabotage was revealed in November 1987 when a single person chopped through vital Telecom cables. The resilience of the system was shown in the speed with which service was restored.

Australian telecommunications are subject to a wide range of threats. Most planning is done for immediate and obvious problems, such as technical breakdowns, major storms and accidental damage. There is little or no planning in the civilian sector for several significant threats. These include:

- * direct military attack damaging central facilities;
- * electromagnetic pulse from a nuclear explosion high above the atmosphere, which could damage or interrupt microcircuits across the entire continent;
- * sabotage by insiders or terrorist attacks by outsiders;
- * interruption of imports, for example due to a naval blockade or to nuclear war in the northern hemisphere which destroys the major industrial powers;
- * industrial conflict;
- * sudden changes in technology, leaving Australia with an entrenched and inappropriate technological infrastructure.

These are illustrations of some key threats; there are numerous others which could be suggested.

The obverse of vulnerability is resilience. A resilient communications system is able to continue to carry out basic functions in the face of major disruptions to its normal working environment. Resilience can be provided by such means as physical protection, redundant systems, flexible systems (adaptable for different purposes), work organisation that offers crucial skills to many workers, and self-reliant manufacturing capacity.

The aim of this project is to examine in detail the vulnerabilities and resiliences of electronic communications systems in Australia. This inevitably means looking at vulnerability and resilience in computing facilities as well. In looking at communications and computing, the aim is to answer several questions.

- * What are the critical vulnerabilities, both technical and human?
- * What are the social and political factors which have led to present level of resilience?
- * What are the simplest steps to make Australian telecommunications more resilient?
- * How should considerations of vulnerability and resilience enter the policy-making process?

20. Nomination of Assessors

Applicants for initial support may nominate up to three persons who are qualified to assess the project and are not associated with it.

Applicant

Surname Martin	Given names Brian	Initials
Institution University of Wollongong		
Project title Vulnerability and resilience in Australian telecommunications		

Nominee 1

Surname Mack	Given names Andrew	Title Mr
Postal address Peace Research Centre, Research School of Pacific Studies Australian National University		
GPO Box 4, Canberra ACT		Postcode 2601
Reason for nomination Leading writer on military threats and defence modes		

Nominee 2

Surname Moyal	Given names Ann	Title
Postal address 8/12 Kareela Road Cremorne NSW		
		Postcode 2090
Reason for nomination Author of history of Telecom; long experience in technology policy issues		

Nominee 3

Surname Lowe	Given names Ian	Title Dr
Postal address Science Policy Research Centre Griffith University Nathan Q		
		Postcode 4111
Reason for nomination Researcher in science and technology policy		

Where an applicant has concern about the Committee using a particular assessor(s), the applicant should nominate the person(s) and provide a brief outline of the reason for preferring that the assessor(s) not be involved.

(Signature of applicant)

/ /
(Date)

Previous work on vulnerability

In work since May 1987 on the vulnerability of the Australian steel industry to military threats, a review of the literature revealed remarkably little work on the vulnerability and resilience of technological systems. The main work done has been on energy, especially in response to the interruption of oil exported from the Middle East.¹ Some work has also been done on the shortcomings of strategic computing in the event of a nuclear crisis.² While the issue of vulnerability has extensive ramifications,³ there is a dearth of detailed studies in any field.

For our study of steel industry vulnerability, we developed a fruitful conceptual framework by listing threats, spelling out consequences and itemising possible responses, and then interviewing knowledgeable individuals in key areas. This research made the connection between vulnerabilities and resiliences in different sectors quite obvious. For example, both electricity and computing are vital for steel production, and therefore we examined these sectors. Electricity and computing are also central to the resilience of electronic communications.

The reasons for focussing now on telecommunications are twofold. The first involves the theory of technology. One of the central questions in studying technology concerns the nature and origins of its neutrality or non-neutrality. For example, why is a technology, designed for one purpose, useful (or not useful) for other purposes? The study of vulnerability enables a practical analysis of the question by showing, for example, how a technological system designed to be resilient against some threats is also resilient against some other, unplanned-for, threats.

Telecommunications is a very different technological system than steel manufacturing -- though there are commonalities -- being essentially a network providing a continuous service as opposed to linear production process supplying a physical product. Therefore, a comparative study of vulnerabilities should be especially revealing theoretically.

Second, telecommunications is absolutely vital to the functioning of contemporary industrial (or post-industrial) society. It is an important social and policy issue to understand and increase the resilience of communications.

1 Wilson Clark and Jake Page, Energy, Vulnerability and War: Alternatives for America (New York: Norton, 1981); James L. Plummer (ed.), Energy Vulnerability (Cambridge, Massachusetts: Ballinger, 1982).

2 Alan Borning, 'Computer system reliability and nuclear war', Communications of the ACM, 30(2), February 1987, pp. 112-131; Lance J. Hoffman and Lucy M. Moran, 'Societal vulnerability to computer system failures', Computers and Security, 5, 1986, pp. 211-217; Perry R. Morrison, 'An absence of malice: computers and Armageddon', Prometheus, 2(2), December 1984, pp. 190-200; David Lorge Parnas, 'Software aspects of strategic defense systems', American Scientist, 73, September-October 1985, pp. 432-440.

3 Amory B. Lovins and L. Hunter Lovins, Brittle Power: Energy Strategy for National Security (Boston: Brick House, 1984)

Research plan

The research plan is designed to focus intensively on the specific vulnerabilities and resiliences of Australian telecommunications, the social and political origins of these vulnerabilities and resiliences, how resilience might be increased, and implications for policy-making.

The first stage is to outline a wide range of threats to Australian society, including direct military attack, nuclear war in the northern hemisphere, electromagnetic pulse, economic blockade, sabotage and massive industrial conflict. Much of the study on some of these threats has already been done as part of the previous project. For others, such as sabotage and industrial conflict, relevant literature will be sought and experts consulted.

The second stage is to examine in detail the vulnerabilities of Australian telecommunications to these particular threats. These will include direct destruction of key facilities, widespread localised destruction of facilities, loss of imports of vital parts, interruption of electricity supplies, and loss of skilled labour. The main focus will be on civilian systems which provide for the continuing functioning of society, rather than on military systems.

The third stage is to examine possible responses to these difficulties. These include physical protection, stockpiling, using different technologies, promoting local manufacturing capacity, and changing work organisation and promoting acquisition of skills. Each response will provide some added resilience.

The fourth stage is to spell out implications for policy-making. This involves highlighting ways to increase resilience and exposing trends which seem to increase vulnerabilities.

The second and third stages will proceed in three steps. First will be a survey of the literature on vulnerability and resilience in communications generally, focussing on electronic communications and computing. Some of this has been done already -- showing the lack of work in the area -- but a more thorough search will be carried out, including computer searches.

The second step is collection of detailed information on Australian telecommunications. Information to be studied will include types and origins of equipment, availability of spare parts, numbers and types of technical personnel, availability of backup personnel, the degree of overseas ownership and management, the capacity and readiness of backup systems, and the availability of alternative ways of accomplishing the same task. As much information as possible along these lines will be obtained from a close study of reports from relevant companies and government bodies, government statistics and technical documents.

The third and most important step is interviews and consultations with people in the areas concerned. This includes management, engineers (a highly knowledgeable group), programmers, technicians and workers. These people are able to provide detailed information and insights into system vulnerabilities and the likely effectiveness of different responses, and occasionally to provide written documentation. The interviews will be closely structured to obtain information about vulnerabilities to specific disruptions, about planning for different contingencies and thus about the origin of resiliences, and about the viability of options to increase resilience.

To arrange the interviews, preliminary contact by phone will be followed by letters to request relevant written materials and agreement to undertake programmes of interviews. Most of the interviews will be solicited directly by phone or personal contact. The most fruitful pattern is to obtain further names from each interviewee.

While Telecom is an obvious source for interviews, approaches also will be made to equipment suppliers, industry consultants, computing firms, relevant government departments and others.

Some discrepancies between technical points made by different individuals are to be expected. It is anticipated that considerable effort

will be required to check and confirm points of detail and interpretation. This follow-up work will be carried out by phone and personal contact.

The fourth stage, as noted earlier, concerns policy options. As the possible responses to specific vulnerabilities are elaborated, their implications for different policy-making models will be assessed. These models include top-down planning (synoptic rationality), intervention by any of various groups (specifically, government bodies and trade unions), and participatory planning which involves citizens and workers.

The social science literature on technology will be examined for perspectives and concepts that might be useful for dealing with vulnerability and resilience. A wide range of issues and perspectives, and hence literatures, are involved in doing this, including sociology of technology,⁴ the entrenchment of technology,⁵ work organisation and technological failure,⁶ military policy,⁷ technology and trade policy,⁸ and risk assessment.⁹ While some work in these areas can feed into the study of vulnerability and resilience, at the same time the study itself can provide data and concepts for critically assessing theories of technology. For example, it will be possible to test the dramatic claim by sociologists of technology that they have an all-encompassing theory by seeing whether the processes leading to resilience flow naturally from their frameworks or have to be imported into their picture artificially.

A highly important outcome of the project is the process by which the research itself is carried out. The interviews serve not only to extract information from specialists but also to sensitise them to the issues of vulnerability and resilience. Circulation of a draft paper to interviewees will serve to encourage their active consideration of the issues. It is planned that, in addition to scholarly papers reporting the research, reports of the findings be communicated to wider audiences, in the belief that wider public understanding and perhaps involvement is an important stimulus for fostering more resilient communications.

4 Wiebe E. Bijker, Thomas P. Hughes and Trevor J. Pinch (eds.), The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology (Cambridge, Massachusetts: MIT Press, 1987).

5 David Collingridge, Technology in the Policy Process (London: Frances Pinter, 1983).

6 Larry Hirschhorn, Beyond Mechanization (Cambridge, Massachusetts: MIT Press, 1984); Charles F. Sabel, Work and Politics (Cambridge: Cambridge University Press, 1982).

7 Ross Babbage, Rethinking Australia's Defence (St Lucia: University of Queensland Press, 1980); J. O. Langtry and Desmond Ball (eds.), A Vulnerable Country? Civil Resources in the Defence of Australia (Canberra: Australian National University Press, 1986).

8 Richard Joseph, 'Recent trends in Australian government policies for technological innovation', Prometheus, 2(1), June 1984, pp. 95-97; P. J. Morris, 'Australia's dependence on imported technology', Prometheus, 1(1), June 1983, pp. 144-159.

9 Charles Perrow, Normal Accidents (New York: Basic Books, 1984).

Timetable**Months 1-4**

Examination of possible threats, including consultation with experts.
Preliminary study of communications generally and telecommunications specifically.

Initial contact with individuals and organisations.

Months 5-12

Study of detailed material about Australian telecommunications.

Formulation of interview schedules.

Main body of interviews.

Further search for detailed information.

Months 13-18

Collating and assessment of information about vulnerabilities and resiliences.

Follow-up interviews and checking of details.

Examination of policy options and theories of technology.

Circulation of draft paper to interviewees and others for comment.

Months 19-24

Further follow-ups as responses are available on the draft.

Integration of material on policy and theory with technical material.

Further writing up of results.

Justification of budget

The funding of a full-time Research Associate for two years is essential to enable the collection of relevant information, arranging and participating in interviews, study of detailed documentation and assessment of the information obtained. An appointment at the level of Research Associate is necessary to obtain a person with sufficient technical expertise, research ability and initiative to carry out the literature searches, technical reading and interviewing required. The interdisciplinary nature of the area plus the lack of previous work in the area means that a person with both a breadth of understanding of the social and economic aspects of vulnerability, plus an ability to grasp detailed technical issues, is required. Such people are known and in Australia.

Travel by both the Chief Investigator and the Research Associate to Sydney, Canberra and Melbourne is necessary to obtain documentation and especially to carry out interviews. The travel budget covers two trips to Melbourne (aeroplane) -- where, among other things, are found the important Telecom laboratories -- two trips to Canberra (bus) -- where important policy figures are to be found -- and 12 trips to Sydney (train) for the Chief Investigator and the Research Associate, plus a per diem allowance for the trips to Melbourne and Canberra.

Finally, obtaining relevant documentation will entail expenses for computer searches, photocopying and purchasing reports.

Relevant publications

The most immediately relevant work is that begun in May 1987 on the vulnerability of the steel industry to military threats. A lengthy draft paper (12,000 words), 'The vulnerability of steel production to military threats', has been extensively circulated for comment; copies have gone to the referees suggested for this project. A second paper is also in draft form. These two will be submitted for publication by June 1988 and are available to the Committee on request. A third paper is in preparation.

During 1988 work will proceed on a study 'Vulnerability to electromagnetic pulse', under a University of Wollongong Research Grant, which will provide valuable preparation for the proposed project.

Previously published work included in the following list also bears on many aspects of the project: the publications on electricity grid modelling and on nuclear power involved detailed analysis of complex technological systems; the booklet Capital Defence involved interviewing of experts on issues relating to social and technological systems, including communications; a number of papers resulted from studies of the physical and social consequences of war, especially nuclear war; and the papers dealing with social defence, as well as some work on environmental issues, have covered a number of important questions concerning self-reliance.

Also relevant, though only implicitly apparent in publications, is 20 years of experience in computer programming, providing some insight into this area.

PUBLICATIONS, 1983-

(i) Publications directly related to the project

Colin Kearton and Brian Martin. The vulnerability of steel production to military threats. To be submitted to **Materials and Society**.

Colin Kearton and Brian Martin. Technological vulnerability: a neglected policy issue. To be submitted to **Prometheus**.

(ii) Publications in other fields (starred items bear on the project)

* Brian Martin. Science and war. In: Arthur Birch (editor), **Science Research in Australia** (Canberra: Centre for Continuing Education, Australian National University, 1983), pp. 101-108.

* Brian Martin. Social defence and the Indonesian military threat. **Peace Studies**, no 4, pp. 5-8 (July 1984).

Brian Martin. Extinction politics. **SANA Update**, no 16, pp. 5-6 (May 1984); Extinction politics revisited. **SANA Update**, no 21, pp. 15-16 (October 1984).

Brian Martin. Science, war and peace (I): building a lasting activism. **Peace Studies**, no 7, pp. 9-12 (October 1984).

* Brian Martin. **Uprooting War** (London: Freedom Press, 1984), xi+298 pages. Chapters 1 and 2, slightly edited, reprinted as: The limits of the peace movement. **Our Generation**, vol 17, no 2, pp. 3-21 (Spring/Summer 1986).

Brian Martin. The social construction of Australian peace movement demands. In: Paul Patton and Ross Poole (editors), **War/Masculinity** (Sydney: Intervention Publications, 1985), pp. 87-99.

Brian Martin. Peace research: centre and periphery. **Peace Studies**, pp. 26-27, 49 (November/December 1985).

* Jacki Quilty, Lynne Dickins, Phil Anderson and Brian Martin. **Capital Defence: Social Defence for Canberra** (Canberra: Canberra Peacemakers, 1986), 68 pages. Also published in Italian as: **Un Modello di Difesa Popolare Nonviolenta** (Molfetta: Edizioni la Meridiana, 1987).

Brian Martin. Nuclear disarmament is not enough. **Peace Studies**, no 3, pp. 36-39 (June/July 1986).

Brian Martin. Social defence: elite reform or grassroots initiative? **Social Alternatives**, vol 6, no 2, pp. 19-23 (April 1987). Reprinted in **Civilian-based Defense: News & Opinion**, vol 4, no 1 (June 1987), pp. 1-5.

Brian Martin. The Nazis and nonviolence. **Social Alternatives**, vol 6, no 3 (August 1987), pp. 47-49.

Brian Martin. The limitations of bilateral peace treaties. **Social Alternatives** (to appear).

Brian Martin. Suppression of dissident experts: ideological struggle in Australia. **Crime and Social Justice**, no 19, pp. 91-99 (Summer 1983). Reprinted in **Philosophy and Social Action**, vol 11, no 4, pp. 5-19 (Oct-Dec 1985).

Brian Martin. The selective usefulness of science. **Queen's Quarterly**, vol 90, no 2, pp. 489-496 (Summer 1983).

Jill Bowling and Brian Martin. Science: a masculine disorder? **Science and Public Policy**, vol 12, no 6, pp. 308-316 (December 1985).

Gabriele Bammer, Ken Green and Brian Martin. Who gets kicks out of science policy? **Search**, vol 17, nos 1-2, pp. 41-46 (Jan-Feb 1986).

Brian Martin, C. M. Ann Baker, Clyde Manwell and Cedric Pugh (editors). **Intellectual Suppression: Australian Case Histories, Analysis and Responses** (Sydney: Angus & Robertson, 1986), including the following chapters:

Brian Martin, C. M. Ann Baker, Clyde Manwell and Cedric Pugh. Introduction, pp. 1-7.

Brian Martin. Science policy under the whip, pp. 79-86.

Brian Martin. Mutagens and managers, pp. 123-129.

Brian Martin. Archives of suppression, pp. 164-181.

Brian Martin. Elites and suppression, pp. 185-199. Reprinted in **Philosophy and Social Action**, vol 12, no 2, pp. 31-50 (April-June 1986).

Brian Martin, C. M. Ann Baker, Clyde Manwell and Cedric Pugh. Options for dissidents, pp. 243-252.

Brian Martin and Clyde Manwell. Publicising suppression, pp. 253-256.

Brian Martin. Suppression and social action, pp. 257-263.

Brian Martin. Suppression in science. In: Barry Butcher et al., **Science in Culture** (Victoria: Deakin University, 1986).

Brian Martin. Science policy: dissent and its difficulties. **Philosophy and Social Action**, vol 12, no 1, pp. 5-23 (January-March 1986).

Brian Martin. Bias in awarding research grants. **British Medical Journal**, vol 293, pp. 550-552 (30 August 1986).

Brian Martin. Agent Orange: the new controversy. **Australian Society**, vol 5, no 11, pp. 25-26 (November 1986).

Brian Martin. Nuclear suppression. **Science and Public Policy**, vol 13, no 6, pp. 312-320 (December 1986).

- Brian Martin. The issue of intellectual suppression. **Philosophy and Social Action**, vol 14, no 1, pp. 3-14 (January-June 1988).
- Brian Martin. The sociology of the fluoridation controversy: a re-examination. **Sociological Quarterly** (to appear).
- Brian Martin. Analysing the fluoridation controversy: resources and structures. **Social Studies of Science** (to appear).
- Brian Martin. Coherency of viewpoints among fluoridation partisans. **Metascience** (to appear).
- * Brian Martin. Nuclear winter: science and politics. **Science and Public Policy** (to appear).
- Brian Martin. Proliferation at home. **Search**, vol 15, no 5-6, pp. 170-171 (June/July 1984).
- Brian Martin. Environmentalism and electoralism. **Ecologist**, vol 14, no 3, pp. 110-118 (1984).
- Brian Martin. Cracks in the Ringwood solution. **Chain Reaction**, no 40, pp. 32-36 (December 1984 - January 1985).
- * Ray Kent, Brian Martin, Val Plumwood, Ann Thomson, Rosemary Walters and Ian Watson. Bureaucracy. In: **1984 and Social Control** (Sydney, 1985), pp. 25-33.
- Brian Martin. Self-managing environmentalism. **Alternatives: Perspectives on Society, Technology and Environment**, vol 13, no 1, pp. 34-39 (December 1985).
- Jill Bowling, Brian Martin, Val Plumwood and Ian Watson. Strategy Against Nuclear Power. **Social Alternatives**, vol 5, no 2, pp. 9-16 (April 1986).
- Brian Martin. Bloodletting in academia. **Australian Society**, vol 2, no 1, pp. 16-18 (1 February 1983).
- Brian Martin. Disruption and due process: the dismissal of Dr Spautz from the University of Newcastle. **Vestes**, vol 26, no 1, pp. 3-9 (1983).
- Brian Martin. Exploiting the academic peons. **Australian Society**, vol 2, no 9, pp. 28-29 (1 October 1983). Reprinted as: Academic exploitation. In: Martin et al., **Intellectual Suppression**, 1986, pp. 59-62.
- Brian Martin. Academics and social action. **Higher Education Review**, vol 16, no 2, pp. 17-33 (Spring 1984).
- Brian Martin. Plagiarism and responsibility. **Journal of Tertiary Educational Administration**, vol 6, no 2, pp. 183-190 (October 1984).
- Brian Martin. Merit and power. **Australian Journal of Social Issues**, vol 22, no 2, pp. 436-451 (May 1987).
- Brian Martin. Academic scapegoats. **Zedek**, vol 7, no 3 (August 1987), pp. 476-481.
- Brian Martin. Education and the environmental movement. In: Tom Lovett (ed.), **Radical Approaches to Adult Education** (London: Routledge and Kegan Paul, 1988, to appear).

Brian Martin. What should be done about higher education? **Social Anarchism** (to appear).

Brian Martin and D. T. Wickramasinghe. Magnetic field distributions in white dwarfs. **Monthly Notices of the Royal Astronomical Society**, vol 206, pp. 407-422 (1984).

Brian Martin and D. T. Wickramasinghe. Polarization angle in magnetic white dwarfs. **Astrophysical Journal**, vol 283, pp. 782-786 (15 August 1984).

D. T. Wickramasinghe and Brian Martin. The magnetic field of AM Herculis. **Monthly Notices of the Royal Astronomical Society**, vol 212, pp. 353-358 (1985).

Brian Martin and D. T. Wickramasinghe. A test of the dipole model for the rotating magnetic white dwarf Feige 7. **Astrophysical Journal**, vol 301, pp. 177-184 (1 February 1986).

D. T. Wickramasinghe and Brian Martin. Magnetic blanketing in white dwarfs. **Monthly Notices of the Royal Astronomical Society**, vol 223, pp. 323-340 (1986).

Brian Martin and Mark Diesendorf. The economics of large-scale wind power in the UK: a model of an optimally mixed CEGB electricity grid. **Energy Policy** vol 11, no 3, pp. 259-266 (September 1983).

Brian Martin and John Carlin. Wind-load correlation and estimates of the capacity credit of wind power: an empirical investigation. **Wind Engineering** vol 7, no 2, pp. 79-84 (1983).

Mark Diesendorf and Brian Martin. Optimal generation planning for electricity grids containing wind farms. **Proceedings of the Solar World Congress**, Perth 1983, vol 4, Pergamon Press, pp. 2323-2329 (1984).