New Zealand After Nuclear War

THE BACKGROUND PAPERS

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460

CONTENTS

1a. The Likelihood of Nuclear War; 1b Study Assumptions, by the Study Team

2. Impacts on New Zealand's climate and growing season, by A.B. Mullan and M.J. Salinger

3. Impacts on New Zealand's natural environment, by Bob Brockie

4. Meeting New Zealand's food needs, by Diane Hunt

5. Effects of electromagnetic pulse on power and communications, by Gerald Coates

6. Impacts on energy systems in New Zealand, by Jeanette Fitzsimons

7. Impacts on communications systems in New Zealand, by Judith Wright with contributions from John Tiffin and Harry Whale

8. Disruptions to transport systems in New Zealand, by Judith Wright

9. Radiation effects on the environment and people of New Zealand, by Peter Roberts

10. Impacts on health and the health care systems in New Zealand, by Phillipa Kitchin

11. Human responses to disaster - a review, by Neil Britton

12. The impact on New Zealand society, by Cathy Wylie

13. Impacts on New Zealand's urban systems, by David Haigh

14. Government agencies for control and recovery in New Zealand, by John Mitchell

15. Policy options and planning approaches for the New Zealand government, by a working party

16. Initial impacts on New Zealand's financial sector, by Peter Rankin with contributions from Paul Tompkinson

17. Initial disruptions to trade and employment in New Zealand, by Kevin Makin and Campbell Gillman

18. International migration to New Zealand, by Judith Wright

19. Implications for links with South Pacific countries, by Kevin Clark and David Small

BACKGROUND PAPER 7

IMPACTS ON COMMUNICATION SYSTEMS IN NEW ZEALAND

by Judith Wright with contributions from John Tiffin and Harry Whale

This is one of a set of background papers prepared, in consultation with the Nuclear Impacts Study Team, from material provided by a wide range of contributors for the study of the impacts on New Zealand of a major nuclear war. Along with other sources the papers comprised the basis of the book ***New Zealand After Nuclear War****, by Wren Green, Tony Cairns and Judith Wright, published by the New Zealand Planning Council, 1987. The assumptions that the study was based on are explained in Background Paper 1, note particularly the assumption that New Zealand is not a target, and the variable assumption involving an electromagnetic pulse (EMP - for an explanation, see Background Paper 5).*

INTRODUCTION

Communication is the art of conveying messages from one person to another, by word, picture, sound or touch. It includes personal communication (conversations, letter writing, telephone calls); the mass media (television, radio, newspaper, journals), advertising, the psychology of perception; the communication of information to systems (for instance the successful operation of the National Grid relies on information about electricity production relayed by computer).

Today communication is as much involved with the conveyance of messages from one machine to another as between people. This paper concentrates on communication technology, and how it would be affected by nuclear war. The traumas that would occur if people couldn't communicate with their families, and the breakdown of national cohesion that might result if communication between citizens was not possible, can only be hinted at.

As one political scientist from Auckland wrote:

> "Following a large scale nuclear exchange confined to the Northern Hemispere, the first problems in New Zealand would be psychological with their consequences for public order. Men, women and children would have to cope with waves of fear, despair, helplessness, isolation and temptations to panic action by irrational, aimless flight.
>
> "The prime and immediate need would ... be for information and direction, as much and as plain as could be provided, and as authoritative and without contradictions as prior planning and consideration could make it. The major demands would be to be told what is known of what happened overseas at a time when world communications would be disrupted and the few reports fragmentary; to be informed about the immediately forseeable consequences for New Zealand; to be reassured on how the authorities were taking charge of the situation all over the country; and to be told of what was expected from individuals, families, groups and communties.

"The prelude to a major nuclear war is very likely to be brief or virtually non-existent ... Therefore there would be little or no opportunity for the key elements of New Zealand's political and communications systems to be relocated or regrouped in preparation for the consequence of a northern catastrophe. So any preparations would need to have been completed already."

The importance of a functioning communication system cannot be overstated. A national communications system is the nervous system of our civilisation. Without it, in a country where the population is as scattered and as small as that of New Zealand, there would be a great danger of a collapse into anarchy following the trauma of a world nuclear war.

The comunications system in New Zealand is changing at great speed. New technology, involving electronic chips, bits and bytes, is being introduced daily. The electromagnetic spectrum used by communication technologies is today what land used to be 100 years ago. Then geographers were lauded for exploring unknown continents, while imperialists sought power through possession. Today technocrats are encouraged to explore the realms of the electromagnetic spectrum while communicators scramble to control the airwaves.

Communication systems do not operate in isolation. Many aspects of society rely on the telephone lines (not only for telephone conversations but for facsimile machines, computer links, broadcasting transmission). News is acquired by broadcasters and newspapers via telecommunications (telephone, satellites, telexes). Broadcasters rely on newspapers for information, and vice versa. Computers are used extensively in all aspects of communication systems.

Broadcasting

The high cost of television programme production and technical facilities has led to production facilities being located in only a few centres. Television in New Zealand is currently controlled by the Broadcasting Corporation of New Zealand. The BCNZ operates from six studios, two in Auckland, two in Wellington, one in Christchurch and one in Dunedin. BCNZ also operates 65 medium-frequency radio stations from 38 localities.

Radio and television services in New Zealand are broadcast by means of radio waves as defined in the Broadcasting Act. Programmes are carried from the studios to the primary transmitters over Post Office telecommunication links or Broadcasting Corporation microwave radio telecommunication links.

In areas of poor reception of primary transmitters, and where the establishment of further primary transmitters would be uneconomic, the broadcast signals are rebroadcast on a different frequency by a repeater station or translator. Repeating is required more for television transmission than for AM radio as the high frequencies used for television are, among other things, more prone to shadowing by hills than the lower frequencies used for AM radio.

The Act requires the BCNZ to provide a radio service and TV1 and TV2 service, as far as is practicable, to the whole of New Zealand. Television services now cover all but about 3% of the population. This level of coverage took many years to achieve, starting in the main urban centres and spreading out to the rural areas as funds permitted.

While 95% of households own television sets, New Zealanders own nearly 5 million radios, about four in every household. Both radio and television are used by the public to receive their news. The Network News at 6.30 pm is always in the top ten of the most popular television programmes, and often the most highly rated. Radio, however, is the medium which 78-87% of the population believes brings them the latest news most quickly according to The Four Mass Media Survey published by the Audience Research Unit, BCNZ.

Telecommunications

New Zealand's telecommunication services (which provide both voice or telephone services, and record services, i.e. telex and facsimile) may be split into the three main categories of international, national and local. The main technologies employed are:

- internationally - high frequency (HF) radio (3-30 MHz), undersea cables, satellite transponders;
- nationally - medium frequency (MF) radio broadcasting (.5-1.5 MHz), microwave links for both telephones and television station interconnection, land lines (overhead telephone lines), buried cables (including some optical fibre cables);
- locally - MF and FM radio broadcasting, television broadcasting, overhead and buried telephone lines, short microwave links, very high frequency (VHF) mobile systems.

In the near future there will be increasing use of satellites for national communications systems, since these are much more versatile and are becoming very cost-effective when compared with fixed microwave links. It is also likely that the use of short-distance microwave links will become much more common in local systems.

International services

The main methods of communicating are, in historical order, cables (largely undersea), HF radio and geostationary satellites.

New Zealand's first external link was an undersea cable to Australia (1876) that could carry telegraph signals (essentially Morse code). It was not until about 1962 that the technology of constructing amplifiers that could be submerged with the cable and thus used as repeaters made possible the transmission of telephone conversations. Since that time great advances in the capacity of cables have been achieved and, with the advent of fibre optic, there is effectively a surplus of capacity in modern cables.

The present network of international cables carries roughly half of New Zealand's overseas telephone and data communications. These are very reliable and have the operating advantage over satellites that the disturbing delay that is present using satellites for telephone conversations does not occur. Future cables will contain optical fibres that will allow them to handle television signals. They will then, for most practical purposes, be interchangeable with satellite systems.

Prior to the installation of telephone cables, the discovery of the ionosphere,

and its effect in making long-distance radio possible, led to the development of HF radio communications that could also be used for overseas telephones. The New Zealand Post Office operated many point-to-point circuits in collaboration with other countries.

HF radio is also used for point-to-point communications with those ships, aircraft and countries that cannot be reached by either cable or a satellite system. In many cases it is coming to be regarded as a back-up system for fixed links, although it is still widely used for shortwave radio broadcasting to remote places. Islands in the Pacific, for example, are dependent on shortwave broadcasts for their news. There is a limited amount of space available in the HF bands, and not all frequencies can be used for all purposes since the ionosphere changes its characteristics during each day and from year to year in a way that is not entirely predictable. The use of various bands is governed by international agreement, although it is generally possible for low-power stations to be swamped by high-power stations or to be intentionally jammed by interfering signals.

From 1971, New Zealand has used the International Satellite System that is based on a series of geostationary satellites. These are satellites that have been launched so that they stay in a circular orbit at a constant height of about 36,000 km above the equator. In this orbit they circle the earth once in 24 hours and, since they travel in the same direction as the rotation of the earth, always appear to be in the same position when observed from some place on the earth's surface. There are other satellites designed to provide communications for special purposes that are in different orbits. For example, geostationary satellites are not suitable for arctic and antarctic regions because they are permanently below the horizon in these areas. A series of orbiting satellites that pass over the ground site at regular intervals are used by the USSR and by other organisations to provide communications to such areas.

For communications purposes the satellites act as transponders, i.e. they receive signals that are sent up to them from the ground, amplify these signals and then send them back to the ground. Various configurations of antennas are used but generally the signals from the satellite can be received over an area up to one-third of the earth's surface. The satellites use solar energy as their source of power and, in order to provide as many circuits as possible, work with ground stations that have large dish-shaped antennas. Smaller ground stations with more limited capabilities are used for special purposes, particularly where only a few circuits are needed, and some direct broadcasting satellites (DBS) are specifically designed to provide high-power transmissions for a few television channels so that small home-receiving dishes of about 1.5m diameter can be used.

There is a continuing debate on the relative values of satellite and cable communication systems. At present they are used interchangeably for point-to-point communications although not all cables can carry television signals as yet. In the future, satellites will be employed where their versatility and broadcasting capabilities are important and cables will be used for permanently fixed circuits.

Of particular importance is the fact that the same geostationary satellites are used by both the Northern and Southern Hemisphere for communications purposes. Other satellites, for weather surveillance and other types of surveillance, also use the geostationary configuration.

National Services

There is a main trunk communications system that is partly underground cable, some of which is fibre optics, and partly a series of microwave links.

Microwave links are a very efficient method of providing many circuits, including television links if necessary, between points up to 100 km or so apart. The intervening path must be clear so that, for maximum range, the terminals (antennas) are usually mounted on towers on hill-tops. Power must be supplied to run the transmitters and receivers but most installations are provided with standby power supplies that can operate for many hours. In New Zealand, specialised links have been provided to enable microwave links to carry television signals. Although other communications channels can also use such television linking systems, they do not always connect the places that could use such facilities.

There is a limit to the number of circuits that can be accommodated on a given link and, for very high-density routes, fibre optic cables are coming into use. These have the advantage that a large number of fibres, each roughly equivalent to one microwave system, can be accommodated within the same cable, and fibres that are being developed will be useable over 100 km or more without repeaters. Both the above systems are relatively inflexible as far as the positions of the terminals are concerned, i.e. they are point-to-point systems. For greater flexibility in the location of the terminals, satellites are being used for internal communications. These are generally the same geostationary satellites that are used for international communications.

Broadcasting systems use a transmitting antenna that often consists of a vertical metal tower. Television broadcasting antennas have smaller elements that are mounted on a supporting tower in order that they be as high as is economically reasonable above any close obstructions.

Local services

The overhead telephone lines (or the buried equivalents in inner-city and newly developed areas) are used for connecting subscribers to the area telephone exchange. Most such lines are less than 5 km long, although there are much longer lines in rural areas. Special lines can be provided for data links that need higher capacity than can be carried on the standard telephone line and, in special cases, short microwave links can be set up to carry such traffic. Telephone lines are strung in pairs which provides a balancing effect that reduces the susceptibility of the system to lightning effects and interference from outside sources.

There is increasing use of mobile systems that generally use VHF radio, where the base transmitter/receivers are located on hill-tops or other high spots in order to give adequate coverage. Future mobile telephone systems will be similar, incorporating a network of interlinked automatically-controlled transmitter/receiver bases operating in the VHF radio bands.

Newspapers

Every major city and town in New Zealand is serviced by either a daily or a

community (usually free) newspaper. The industry employs approximately 10,000 people directly and 5,000 indirectly (newspaper agents, delivery personnel, etc). It has been and is going through significant technological changes where labour-intensive methodologies are being replaced by computer-based typesetting systems.

Newspapers as we know them today contain two separate sets of information - editorial and advertising copy. Editorial copy is received from local reporters; from reporters in other areas (information is sent via telephone or facsimile printing machines); or from the New Zealand Press Association (which has three sources: member newspapers in New Zealand, agents employed outside New Zealand, and other news agencies, e.g. Reuters.) The information received by the NZPA, either electronically or by telex is re-directed to NZPA members in New Zealand, again electronically or by telex machines.

Presses in all newspapers are electrically driven. Most newspapers, in the event of a power failure, have backup power units. Printing plates and ink are imported through agents in New Zealand. Newsprint used in the industry is produced by Tasman Pulp and Paper Company, at Kawerau, New Zealand. At any one time in New Zealand there are at least 60,000 tonnes of newsprint either awaiting shipment or stored by publishers. Tasman considers that:

> "Properly utilised, this quantity of paper would serve the essential communications needs of a post-nuclear war society for 3-4 years or more. Assuming that limited production at Kawerau was also possible, this period could be extended for many more years."

LIKELY IMPACTS OF NUCLEAR WAR IF NO EMP

If power were available all sections of the communication system could operate, until supplies of essential imported spares were depleted (which would cause a problem for the electronics industry). The major exception would be the telephone system, which would suffer from overloading. At present a 20-25% increase in use causes overloading, a situation not uncommon in the busy weeks before Christmas.

People in New Zealand would expect to get information from their telephone, radios and televisions, as did the Americans in the following anecdote told by John Tiffin, Victoria University:

> "I was in Washington doing a survey by telephone with a team of six people when one by one, they said they were having trouble with the telephone. I was renting the line and had a special number to call in case of trouble. As I tried to contact it, members of the team took the opportunity to call home. A touch of alarm crept in as they discovered they could not get through on any line. Suddenly the number I was ringing answered. A harsh voice said: "Get off the line. There's a national emergency". I realised everybody in the room was looking at me in a peculiar way. I said "Quick get the television and the radio". There was no talk or discussion, everybody sensed the moment and moved fast. The television worked, and we heard that President Reagan had been shot."

Broadcasting

In general there would be sufficient components on hand to sustain broadcasting services for two to five years before shortages would have significant impacts on

major areas of population.

If there was a loss of power, both television and radio stations could continue broadcasting using their standby diesel generators, but only battery-operated sets would be able to receive the signals. While there are many battery radios, there are few battery-operated television sets.

Without electricity, substantial quantities of diesel fuel would have to be assured for continued transmission. The main radio and television transmission sites are equipped with diesel generators that would allow transmission for no more than a week, though radio sites could acquire fuel and essential parts from television sites, which would extend the period in which there was some transmission.

Newspapers

Information transmitted via telecom links would still be available to New Zealand newspapers, although an overloaded telephone system would cause tremendous delays. Overseas information would be limited, depending on the extent of the action in the Northern Hemisphere. Newspapers could still maintain production, albeit concentrating on local news and any information received from Australia.

Problems would arise as soon as imported stocks of inks and printing plates ran out.

Paper could still be produced by Tasman, depending initially on the availability of electricity, transport fuels, skilled staff, and the cannibalising of plant equipment. In the longer term, production could be hindered by a lack of paper-making fabrics, replacement parts for heavy reels, rollers bearing, electric motors, grinding stone and plates, and "innumerable other pieces of equipment".

LIKELY IMPACTS OF NUCLEAR WAR WITH AN EMP

In the words of John Tiffin, under this scenario, "the most likely indication for New Zealand that a nuclear war had occurred would be that electronic equipment would stop. Radios, television receivers, telephones, computer terminals would all stop working. Fridges, fans, electric stoves, ovens, electric heaters would go off. If it were at night, all the lights would go out. If it were day, there would be sudden quiet as the hum of industrial activity stopped. The electronic equipment in cars and aeroplanes, buses and trains would cut out. People would be trapped in lifts and rooms with security systems. The electronic heart of our civilisation would stop beating. If the moment came in the small hours we would wake up to a gradual realisation. If it happened in the middle of the day or the early evening the effect would be traumatic. Imagine it on a Friday evening in the winter with the cinemas full and the streets crowded. There may be a strange flash and the colour of the sky might change in an eerie way, but it is unlikely that people and buildings would be directly affected."

The effect would be caused by electromagnetic pulse (EMP), which could be experienced in New Zealand. For instance, satellites travel in very predictable orbits so that they are relatively easily intercepted and destroyed. Since they may be regarded as "eyes and ears" of a nation, they would presumably be classed as high priority targets. For quick and certain destruction, nuclear weapons would

probably be employed and all of these explosions would give EMPs of varying magnitude on the ground. Since the satellites are above the equator, the EMP effects would occur in both the Southern and Northern Hemispheres. Lower level orbiting military communications and surveillance satellites would be attacked where convenient, preferably away from the attacking country's home area.

Damaged systems in New Zealand could include:

- The power system at all levels (from the operations of the New Zealand Electricity Corporation to those of individual Power Boards) including generating stations.

- The telephone (and thus telex and data) network in its entirety (Telecom New Zealand, and internal systems) although some manually- or mechanically-switched portions may survive.

- Broadcasting systems including microwave systems and satellite links which would be vulnerable at their terminals. Base/mobile radio systems connected to power and antennae would be extremely vulnerable. Amateur radio systems would probably largely survive, and could be used during the post-EMP phase if properly co-ordinated.

- Transport and other infrastructural communication systems including railways signalling and the rail electrification system, air traffic control, police and civil defence.

- Infrastructural items using electronic controls or data processing such as hospitals, the banking system, water supply, sewage pumping and treatment, building services including lifts.

- Industrial production, particularly the process industries including major resources such as the oil and gas fields, the refinery, and the synthetic gasoline plant.

Damage would include both permanent damage (e.g. burned out or destroyed electronic components, arc-damaged components such as insulators) and functional impairment in systems operating at the time of an EMP (e.g. digital processing systems such as Databank).

HF radio depends for its operation on reflections from the ionosphere which is situated above about 100 km in height. Nuclear explosions create short-lived ionospheric disturbances in their immediate vicinity but the ionosphere as a whole is extremely robust. If ground terminals are available (transmitters and receivers) then HF communications would survive.

Amateur radio equipment not connected to power or antennae would be unlikely to sustain damage. Simple and inexpensive protection fitted to fully operational equipment would prevent damage in 60-70% of cases, and some damaged sets might be operational although with degraded reception and/or transmission (Bosden, 1986). Amateur radio operators should have at least one functional transceiver each, and many would have access to small portable generators. The Amateur Radio Emergency Corp (AREC) could establish a local communications network within hours, with national coverage available within a few days.

Major communication problems would arise from the vulnerability to an EMP of

telephones, computers and systems which require long land-lines to connect a base receiver to a transmitter.

Broadcasting

In general, microwave and broadcasting systems are designed to operate with high voltages present and the pathway or circuit that connects the external part to the internal parts of the equipment is constructed so that only the signals for which it is designed can get through. These systems are quite robust electrically, but it is unlikely they could withstand the EMP effects assumed in this study.

Given damage to the transmission facilities by an EMP the BCNZ stated:

> "Problems ancticipated include availability of trained staff to restore, maintain and operate the transmission networks and the supply of transmission equipment and components practically all of which are imported from overseas."

There would be sufficient components on hand to sustain services for two to five years although there may be an immediate demand for particular components to restore badly damaged equipment.

Newspapers

As a result of EMP effects, there would be little chance of producing newspapers as they are dependent on electricity and electronic equipment. Even obtaining the information to print would be difficult, if the telecommunication systems were overloaded or inoperable.

Tasman Pulp and Paper Company, producers of newsprint used by the New Zealand newspapers, state:

> "Given that this [an EMP] would put transmission lines out of action, burn out electronic circuits and damage or destroy electronic and electrical equipment, Tasman's operations would be halted immediately and possibly permanently. However, provided sufficient quantitites of undamaged electrical wire were available, skilled technicians amongst the current workforce could probably rig up repairs which would allow a resumption of limited operations, subject to electricity supplies being re-established, and the limitations discussed under Scenario 1 [no EMP effect]."

Telecommunications

Vulnerability of international systems

Geostationary satellites are used for both international and internal communications. Because their location is accurately known they are particularly vulnerable to attack and this means that they would no longer be available for use by neutral countries.

Other satellites, used for communications with the polar regions or for surveillance of these and other regions, are placed in orbits that are nearly

North-South. These require ground stations with antennas that track the satellites as they pass over, in contrast with the geostationary case where only a very slight degree of tracking is required and that only because the orbits are not exactly what they were initially designed to be. The orbiting satellites are usually at much lower altitudes than the geostationary ones and can be regarded as the eyes and ears of their owners. As such, they must be considered as priority targets. Since they must be attacked as soon as the opportunity presents itself they constitute targets that could be located anywhere over the whole earth. Thus, with the geostationary satellites located over the equator and with the orbiting satellites covering the whole world, it is difficult to see how any outbreak of hostilities in the Northern Hemisphere could be confined to that hemisphere.

Submarine cables are vulnerable at their terminations but they are also easily located since they are lying passively on the sea floor and are thus easily cut. Repairing an undersea cable is a major operation that could take months.

All that would remain for international communications would be HF and those systems that rely on scattered reflexions from passive space debris or from the moon. The ionosphere is very robust and, even in an area of conflict, should return to about its normal state in a matter of hours at the most.

Vulnerability of national and local systems

The communications systems that are most susceptible to damage by EMP effects are the terminating exchanges that are connected to overhead wires such as telephone lines, particularly when these run in a North-South direction. Away from the "local" area of an intense EMP, the effects are similar to what would be expected from a close lightning strike.

The telephone network would be largely out of action, principally because of damage to exchange equipment. Currently 25% of telephone exchanges are electronic and this will rapidy increase to 50% within a year or so and 100% by the mid-1990s. Similarly, long distance communications, most of which use solid state repeaters, could be severely damaged. Underground telephone lines and fibre optic cables are well shielded from EMP effects, though their vulnerability increases at the points they are attached to associated electronics.

Any satellites used for internal communications are essentially indistinguishable from those used for international communications, so that the same considerations apply. Special purpose satellites, such as those used for the direct broadcasting of local television by a non-combatant, might not be a direct target but could nevertheless be extensively damaged since they would seldom be located at a distance greater than about 1000 km from other satellites in the geostationary orbit.

Computers and Electronic Controls

The electronic controls and data processing capabilities used for example in hospitals, the banking system, water supply, sewage pumping and treatment, building services, control mechanisms in power supply, would be damaged, rendering the infrastructures out of action.

It is possible that databases stored on computer software would be destroyed.

New Zealand Meteorological Service

The New Zealand Meteorological Service provides weather information services and conducts atmospheric research in New Zealand and the South Pacific. There is a continuous international exchange of information - both data and derived products - and any disruption of this exchange would restrict weather forcasting services to about a 48-hour period. Most of the Service's equipment is of overseas manufacture so in the longer term would not have the ability to acquire, communicate or process much data. Even such basic instruments as thermometers are obtained from overseas so a continuing lack of overseas supplies would eventually lead to an abandonment of all observations except rainfall (which is measured in locally-made rain guages) and observations made without instruments such as those of cloud and visibility. Some New Zealand data is obtained through cooperative arrangements with various other groups and individuals. There is a likelihood that such arrangements would not be maintained at a time of general social and economic distress. Some of the Service's data is obtained remotely from satellites or via satellite communication from automated data sources. Providing communication links survived, data from such sources would coninue to be available for possibly a year or two.

In the event of a disruption of power supplies and communications the Service's activities would be further reduced. Without transmission of data only local forecasts for a few hours ahead could be made.

A normal function of the Meteorological Service is the monitoring of solar radiation, atmospheric particles and trace gases. Such monitoring would be of particular importance following a nuclear war as it would serve as an indicator of the likelihood of other climatic and agricultural impacts. This monitoring is dependent on equipment of overseas origin and on power supplies. It would be highly desirable if sufficient spares and auxiliary power supplies were always available to maintain some basic monitoring programme in the event of a nuclear war.

POST-WAR ADJUSTMENTS

There would be an immediate need to communicate, yet there might not be the systems available to do so. For society to re-build, adequate communication would be essential.

If a communications system, albeit changed in nature and greatly reduced in capacity, could hold New Zealand together as a nation over a period of two years, then the fact that human and material resources were not knocked out should mean that new communication systems based on New Zealand technology could ultimately come into existence, albeit of a less sophistiated and more utilitarian nature than currently exists (John Tiffin).

Amateur radio enthusiasts, who have a long tradition of public service and ingenuity, could be on the air within hours of a nuclear war, forming a nationwide link. There are over 6,000 "ham radio" operators around New Zealand, many in remote areas, and many with the ability to generate their own power. In the words of one operator they would "as a majority, immediately make themselves available, in the case of an emergency."

Broadcasting

It would take radio stations days, rather than hours, to get back on air with a limited service. The major broadcasting operator in New Zealand, the BCNZ (Broadcasting Corporation of New Zealand), would set as its priority the re-establishment of a radio station network. This would comprise initially the four main stations in the National Programme service (1YA, 2YA, 3YA and 4YA) which would reach most of the population of New Zealand.

FM Radio and television networks would probably not be re-established for "some considerable time", though a high priority would be given to the maintenance of the microwave link network. Although this network is designed primarily for television, it could be adapted to provide voice communcations and some data flow if required, perhaps as an alternative route to Telecom circuits, but with much less capacity. BCNZ do have, in both islands, emergency towers which can be towed - given sufficient transport fuel - to almost any location, and set up within hours.

The transmission sites could operate without electricity only if "substantial quantities" of diesel fuel were available for the diesel generators.

Newspapers

Within one or two days, old fashioned handprinting devices could be used to get local newsletters out on a community basis. Paper could be produced by hand, but only on a limited scale. The present stock of 60,000 tonnes could last for three to four years if used sparingly. A longer-term problem would be the availability of lead for printing presses, particularly if other users had priority over re-cycled supplies.

Without imported inks, colour would soon disappear from printed paper and packages. It would be a grey world.

Telecommunications and postal services

Local postal services could operate - the Post Office bicycle fleet of over 1,000 would have a renaissance. National postal services would be limited by available land, air and sea transport.

The telecommunications organisation depends upon a wide range of manufacturing industries, from the manufacture of nails through to the production of fibre optic cable, integrated circuits and associated components. For many of the items there are no alternatives. The telecommunication system is also very dependent on the availability of power from the national grid which, in turn, is dependent for much of its maintenance material on overseas sources.

If the telecommunication industry could re-learn how to make mechanical telephone equipment, and retrain operators in manual techniques, the industry might be able to revert to the technology of the 1930s. The old telegraphic service, which is about to be disbanded in favour of telex and facsimile operations, could be re-built with a return to text-based message systems.

Computers and electronic controls

The use of computing and information technology equipment is now so deeply embedded in New Zealand society it is hard for many to imagine an alternative other than reverting to a system that did not use computers.

If electricity was available small local computers or personal computers might be used in place of mainframe computers, until networks were redeveloped. Key personnel from bady affected countries might be encouraged to migrate to New Zealand to start up indigenous electronic and information technology industries.

PRE-WAR PLANNING OPTIONS

New Zealand is creating for itself a massive dependence on imported technologies and techniques. New Zealand could introduce a degree of protectionism to encourage indigenous initiatives in communciation technologies so that post-nuclear war we could operate our own communication systems. The alternative is to stock up on all essential items, which would be prohibitively expensive.

It is not sufficient to have knowledge of techniques. These must be translated into skills and competencies. In a post-nuclear war New Zealand there would be a sudden need for massive retraining of the population. It has been suggested that without an understanding of the new instructional methodologies which have influenced the development of the USA and Japan, New Zealand's ability to "bootstrap" itself with the new skills and comptencies that will be needed in a post-industrial world would be seriously hampered.

The most effective plan would be one that ensured an immediate network of communications which did not rely on the national grid, or electronic equipment, and one that everyone, not just government, had access to.

Newspaper

The only feasible action to minimise post-war disruptions, according to the newspaper industry, is to ensure that there are sufficient stocks to ensure ongoing production, though interest and storage costs might be prohibitive. To counter an EMP, it might be feasible to have machinery available which is not dependent on a power source to produce information sheets of a localised nature. However, such equipment, even on the world market, may be difficult to obtain.

Computers

In order to minimise post-war disruption, plans could be made to back-up all software and data onto optical disks; maintain a screened store of vulnerable components and some complete computers (although that could be expensive); and increase the use of optical fibres for communications (as these do not act as antennas and hence would not channel EMP energy into equipment).

Broadcasting/Telecommunications

People contacted in connection with broadcasting and telecommunications were not specific about their suggestions for possible pre-war planning, beyond commenting that one could "stock up on essential items, which would be prohibitively expensive, or consider a default position." The degree of protection of the exchange equipment that is economically feasible would depend, to a large extent, on the assessment of the likelihood of large EMPs.

FUTURE RESEARCH

The question of dependence on imported electronics, and the ability of New Zealand's electronics industry to cope with local needs after a nuclear war needs further investigation.

Other suggestions for future research include:

- More work could be done in studying the susceptibility of the computer and communications technologies New Zealand is adopting to the effects of a nuclear war in terms of

  1. Susceptibility of components to EMP;
  2. Long-term problems with spares;
  3. What is required to harden critical elements of a communications system.

  Such a study could provide guidelines for purchasing equipment and systems and might well encourage New Zealand manufacturing initiatives.

- The "landrover computer" could be developed. The motorcar was developed on smooth roads. In the second world war, there was suddenly a need to use motorcars off the road. In consequence the jeep and the landrover were developed. They are not pretty or fast. They are tough, rugged and reliable and have changed very little over the last 40 years. Is it possible to produce a general purpose New Zealand Personal Computer (PC) that is rough, rugged, reliable, EMP-proof, and at a pinch could be manufactured without imported components? As it were, a landrover version of the PC.

- Database preservation. Gordon Hogg has suggested that New Zealand should be a repository of knowledge in the English language. Some believe that New Zealand would, in a post-nuclear war world, have the most extraordinary bargaining power. If, in Tom Stonier's words, information is the new wealth, then New Zealand would truly be the great banker of knowledge.

- A Doomsday database. The British recently revised the idea of a doomsday book in electronic form. There is also the idea of developing a cartographic version of a doomsday book. There could be a national database linked to a national map which could be updated and used for planning and communicating in emergencies.

- A learning industry. A study of the implications for New Zealand of new instructional technologies and their relationship to new communications and computer technology is critical.

CONCLUSIONS

Communication between individual, community, and government would be essential after a nuclear war. An EMP strike over Australia would destroy our present communications system. Even without being at war, New Zealand society could be crippled by lack of communication. Rebuilding electronic equipment would not be possible. Rebuilding 1930s technology would not be easy.

Careful thinking and planning needs to take place as to how the country could communicate in the event of a disruption as catastrophic as the one predicted by this study.

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