

A study of new opportunities for Australian Radio amateurs made possible by changes in the Amateur Radio License conditions

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1. Foreword

After wide public consultation on 19th October 2005 the Australian Communications and Media Authority (ACMA) put into effect several fundamental and far reaching changes to the Australian Radio Amateur Licence. These included:

- Elimination of the Morse code test as a prerequisite for access to frequencies below 30MHz.
- The introduction of a Foundation licence and arrangements to permit holders of other licence classes to operate on a greater range of frequency bands.
- Lifting of the prohibition of third party traffic to amateurs in other countries. In effect, this means that Australian amateurs can now pass messages on behalf of non-amateurs to operators outside of Australia.
- Allowing Amateurs to connect radio equipment to the public telecommunications network and/or internet.
- Participation in CEPT T/R 6-101 recommendations. This is a European agreement that allows amateurs to visit and operate in other participating countries without the need to obtain a special temporary licence from that country.

In the United States, the Morse Code test is still a requirement but the required speeds have been dropped considerably and it seems likely that the test will shortly disappear altogether. Apart from this, all of the other relaxations mentioned have been in place for a number of years. As a result, several mature technologies have been developed that allow communications techniques previously denied to Australian Amateurs.

During this fellowship project I travelled to the United States and United Kingdom meeting individuals and organizations that have designed or operate some of these previously "forbidden" activities. This project report is a summary of my findings. Although the topics I have focused upon are perhaps not generally considered as mainline Amateur activities, all use Amateur Radio facilities to provide a community service. In this way, it is my hope that it will attract an interest in Amateur Radio from groups for whom its resources can provide valuable assistance in their primary objectives.

Acknowledgements

First and foremost, for making this project happen I am most grateful for the help and support I have received from the Winston Churchill trust. My thanks also go to the individuals I visited during my tour. Also to members of the Radio and Electronics Association of South Tasmania. Last but not least, thanks to my wife Diana for endless hours of checking texts and attention to a myriad of practical details that ensured the project's success.

2. The Programme

A. United States

Organisation	Meetings & interviews	Location
Pacific Seafarer's net	Russ Spalding Robert Reed Larry Miller Richard McNish Don Anderson Thomas Welchel Fred Moore	Bend OR Arcata CA Templeton CA Somis CA Oxnard CA Riverside CA Inverness FL
Naval Postgraduate School	Dan Boger	Monterey CA
California Yacht Club	Scott Stolnitz	Marina del Rey CA
Winlink 2000 development team	Rick Muething Vic Poor Steve Waterman	Rockledge FL Melbourne FL Nashville TN
Hurricane Watch Group	Mike Pilgrim	Boca Raton FL
AusieWinlink	Anthony Van Vugt	McLean VA
Seven Seas Cruising Assoc.	Jim Stewart Cruiser Seminar	Dunellon FL Annapolis ML
US Naval Accademy	Robert Bruninga	Annapolis ML
US National Weather Service	Timothy Rulon Lee Chesneau	Silver Springs ML
American Amateur Radio Relay League	Roseanne Lawrence Steve Ewald Steve Ford	Newington CT
Radio hams	Bob and Betty Sisler Ross Keatinge Wesley Whitley George Hunt Chuck Mckusic	Seal Beach CA Milford NH Satellite Beach FL Charlottesville VA Satellite Beach FL

B. United Kingdom

Organisation	Meetings & interviews	Location
North Bristol Amateur Radio Club	Dick Elford	Filton, Bristol
Radio Society of Great Britain	John Crabbe	Potters Bar
UK Maritime Mobile net	Bill Hall	Cobham

3. Introduction

Amateur radio was once considered a fertile training ground for future electronics engineers. Youngsters with a passion for electro technology would develop their skills by building their own communications gear in the back shed, bedroom or kitchen and be thrilled to discover they could make contact with friends a few blocks away and sometimes in other continents. However, as new technologies have emerged this picture has changed and in recent years the number of Australian licensed amateurs has been declining at around 2% per year¹. Most are middle aged or elderly and females are poorly represented. Clearly this situation is unsustainable and reasons for the decline include

- o Email and the internet - These technologies have made international communications commonplace.
- o Increasing equipment complexity - Radio equipment of today is vastly more complex than it was even a decade ago. As a result, the difficulties of constructing a typical multiband transceiver are now well beyond the capabilities of most home builders.
- o Reducing costs - While complexity increases, real costs continue to fall and so further reduce the motivation for home assembly.

Given its current course, the future for amateur radio looks bleak but there is a light on the horizon. The new licence relaxations recently introduced by the Australian Communications Agency have opened a range of new and exciting activities for radio amateurs, mainly in the field of community service. By tradition, amateurs have often been able to provide assistance with marine rescues and in the aftermath of civil or natural disasters. Now, their abilities to provide this type of assistance can be a major objective instead of just an adjunct to technical capabilities.

Writing in the Wireless Institute of Australia's magazine Amateur Radio, editor Colwyn Low wrote:

"So we stand at the door of an important new stage in amateur radio in Australia. If we wish our hobby to survive, then we need to (have) a new generation to join us"

The message is clear; if amateur radio is to survive we must exploit every opportunity to encourage newcomers to nurture interests in the full spectrum of amateur radio activities. As with obtaining a driving licence, few people do it just to 'drive'. So it is with the amateur radio licence; not just to communicate but a chance to go places, meet people and push horizons.

In conducting this Fellowship project, I've looked a number of amateur radio activities that are prominent overseas but have had only a small or non-existent following in Australia. Those chosen are by no means all that are now permitted under the new licence conditions but just a sample based around my own experiences and contacts in the field.

4. The project journey

Beginning near the mountains and forests of Oregon the Fellowship journey took me along the Californian coast to the frantic freeways of Los Angeles; across the Arizona desert and Texas plains to the hurricane torn Gulf or Mexico; from the Florida Everglades to the Blue Ridge Mountains and to New England.

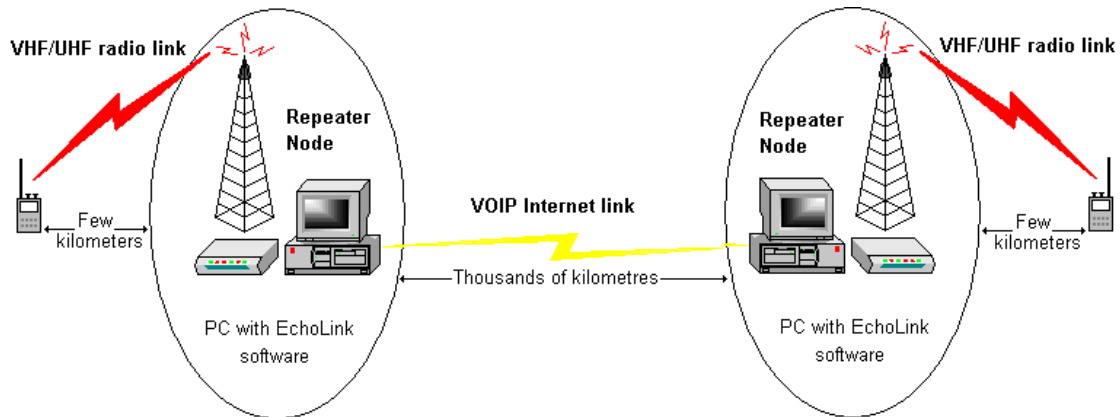


As many of the people I needed to meet were in out of the way places, public transport was not an option. Instead, I rented a Ford Focus and covered 10,800 miles of driving on a side of the road that was foreign to me and by some miracle, managed to hand the car back to Hertz, Boston, unscathed. For the UK leg I hired a Ford KA and departed in mid November, avoiding the worst of the cold weather to come in the USA.

In total I visited some 30 private individuals and institutions. All had strong connections to amateur radio either as system developers, high level participants or as representatives of organisations where amateur radio is an important part. In the remainder of this report I look at a number of amateur radio activities that these people have been involved with.

5. Echo Link

In normal circumstances the range of a hand held VHF/UHF radio such as that shown below would be around 40 km. However, by calling an EchoLink station that is in turn connected to the Internet, simple hand held radios can be used to communicate across the world. Like other amateur radio services, Echolink is provided by amateurs for amateurs, and is free of charge.



The basic EchoLink concept – use of hand held radios to communicate between internet Nodes.

Clayton Reading (VK7ZCR) with Hobart's Echolink repeater station.



The web site (www.echolink.org) is mainly aimed at providing support for their internet service. This includes a downloadable communications program that allows internet connected users without radios to hold telephone like conversations, rather in the style of several other non-amateur services such as www.Skype.com.

EchoLink's real advantage over these services is its ability to serve mobile users with only hand held radios and without their own direct access to the internet. It was this that appealed to me for use as a means of keeping in touch with my wife back home in Tasmania during my Fellowship tour though due to the rather limited support service this was not quite as straight forward as it might have been.

Although the system performed perfectly at her end, as a mobile user, my main difficulties were in knowing when I was within radio range of an internet node and what its operating frequency details were. Having the latest CD copy of the Amateur Radio Relay League's (ARRL) TravelPlus Repeater guide didn't provide the answer and on contacting EchoLink support I was simply reminded that I could find all the details I needed from the web site. This seemed to defeat the major advantage of EchoLink since, if I'd been able to access the internet, I could have used Skype or email to keep in touch and since I was never sure exactly where I'd be from one day to the next, accurate pre-planning was not always possible. An additional problem was that managers of some radio Internet nodes preferred to turn them off before going to bed which made it tougher to communicate between time zones.

Though somewhat frustrating for new users, these are minor niggles that could readily be cleared up by improved documentation and support. With many nodes established around the world EchoLink is none the less an extremely useful tool for long distance communications with minimal equipment.

6. Amateur radio for seafarers

While overall numbers of radio amateurs have been declining, one area in which there has been significant growth is its use by recreational sailors. Every aspect of life at sea is affected by the weather and all seafarers have an overriding interest in knowing how it will behave. For this reason alone they have a natural partnership with radio which brings a wealth of other benefits. Examples include:

- Weather information. Not just voice forecasts but text printouts, synoptic charts, upper atmosphere charts, prognoses, sea temperature charts, currents, grib files, plankton plots – to name but a few.
- Medical concerns. A condition that you are unfamiliar with may or may not be serious. If it occurs at sea do you ignore it, make for the nearest port or call for immediate assistance? A radio call could resolve the issue much faster.
- Port procedures. It is always prudent to obtain details from official sources about entry requirements and procedures at your next port of call before leaving your last. However, official advice is not always the most up to date and it is often more revealing to speak with boat crews that are there.
- Service repair information on failing or failed equipment. It is often useful to discuss problems with someone else that has the same item.
- Links to family and friends. Everyone has read horror stories about the sea and without first hand experience, friends and families sometimes have a poor appreciation of what life at sea is really like. Regular communications, by email and phone are a good way to allay fears, prevent panic and possibly unnecessary summoning of emergency services.

Not included in this list is the need to call for assistance in times of distress. These are times when life or the vessel are in immediate and imminent danger and in such circumstances the first recourse should be the official maritime rescue authorities who have far more extensive resources at their disposal than could be expected of any amateur station. Distress procedures are well covered by the various marine education courses and so will not be discussed here, except to mention the point that because trans-ocean routes sailed by small boats often take them away from regular shipping routes, it is sometimes the case that the only aid that a small boat in distress can expect, must come from another small boat on passage.

There have been many examples of this, and some involving race or rally fleets have become international news items. One was that of the rescue on 16th February 1999 of 'Around alone' sailor Isabelle Autissier whose vessel had capsized in the Southern Ocean. On hearing the news, fellow competitor Giovanni Soldini sailed 200 miles into 35 knot head winds to reach and recover Autissier from her stricken vessel just 24 hours later. Rescue by any kind of aircraft was out of the question and no other vessel was better placed to affect a rescue.

Comparing this type of offshore rescue with others where merchant and military vessels and aircraft may be involved and it is clear that real costs are minimal. For this reason alone, every encouragement should be given to long distance sailors to adopt practices that make it easier for them to participate in rescue and recovery of their fellow mariners.

7. Radio nets

Amateur radio nets are like meeting places; a spot on the dial where a group of people with a common interest can meet at an agreed time to exchange information or ideas. Nets vary enormously with some dedicated to specific topics such as marine position reporting, tracking weather systems or helping manage recoveries following natural disasters such as cyclones, earthquakes or tsunamis. Others are less formal and formed simply to keep up social contacts and chat.

The size of the area over which the net can be spread depends upon its chosen operating frequency. If, for example, it is within the VHF or UHF bands, coverage will be strictly local and ideal for a small town, island, or close group of anchorages. If, on the other hand, the net operates within the HF bands, group members could be thousands of miles apart. Although unsuitable for local contacts, these frequencies have the ability to cover whole oceans and so help cement together communities of people that may be a great distance apart and constantly on the move.

In the Australian outback, this is a function that HF radio has provided for years, helping to unite remote homesteads, though these days it has largely been replaced by satellite phone services. These are unaffected by ionospheric conditions and are good for emergency uses where life or property are under threat. However, unlike HF radio, phone calls cost money and there is no equivalent of the net where an individual participant can be heard by hundreds of others. In other words, phones have no broadcast mode and a call can only be made to people whose numbers you know.

Marine nets

Radio nets are of special value to seafarers. All have a common interest and great need to share information. Items include weather, which is of supreme importance to all seafarers, navigational details, port access arrangements and berthing. Although this type of information is available from official sources through the regular marine channels, it is of a basic general nature, passed without comment, interpretation or explanation and intended mainly for large commercial vessels.

In contrast, amateur radio sources can provide marine users with access to a much wider variety of sources, some more convenient and more appropriate to their needs. For example, a specific marine weather fax chart may only be transmitted once a day and takes 20 minutes to receive. However, a small .GIF, GRIBB (gridded binary data), or fleet code file from an amateur source can provide similar data but may be received at any time and takes only a few minutes. Furthermore, discussing weather with boats that are actually experiencing conditions or systems that may be moving in your direction can often be more revealing than details on a synoptic chart.

Perhaps the most valuable contribution nets can make is in helping avoid disasters before they happen. A developing concern over an equipment fault or possible medical condition may in itself be non-urgent and no reason to call for assistance. However, radio nets often carry specialists in a variety of fields and simply discussing the problem can allay fears or provide advice for managing the situation and thus avoid it developing into a more serious issue affecting overall safety.

Net procedures

Because radio nets operate on a single frequency (simplex), unlike the telephone only one person may speak at any time. If two people speak together (doubling) their combined voices will not be understood by other members of the group. In a simple (undirected) net it is sufficient for each participant, at the end of each voice break (ie. over) to indicate who will talk next.

In busier more formal (directed) nets, smooth running is ensured by one station acting as 'Net Controller'. His/her responsibility is to conduct affairs in an orderly manner and to indicate who is to speak next at the end of each over. By far the best way to understand a particular net's protocols is to listen in for a while and take the time to discover how business is handled before calling in yourself.

Marine nets may vary considerably in formality, structure and content. Some are formed by loose groups of boats travelling the same route, particularly on the more popular seasonal trans-ocean passages. For boats crossing the Atlantic they may begin in the Canaries between November and December, and for those crossing the Pacific, Mexico and Panama in June to August. As boats arrive at their destinations and go their separate ways these nets are inclined to fall apart, to be re-built in slightly differing form the following year by the new group of ocean crossers. Most enduring are nets that include a proportion of shoreside stations who provide continuity of spirit from one season to the next. Some centre around a single stalwart enthusiast who over the years has built up their own user group and dedicates an hour or so each day to serving their needs. Others have many shoreside stations who, by acting as relays, are able to extend the net over a much larger geographical area

8. The Pacific Seafarer's net

This daily net has run for decades and is supported by many shoreside control and relay stations along the US West coast, Hawaii, Australia, New Zealand, Pitcairn and other islands of the Pacific Rim. Beginning at 0300 UTC it operates on 14.313MHz

It mainly serves small boat sailors in the Pacific though from time to time it has maintained regular contacts with circumnavigators. Like all oceanic nets, its busy time is determined by annual weather patterns, so a typical year's activities start to build around March/April when boats are gathering along the Mexican and Panamanian coasts for the 3 or 4 thousand mile journey to French Polynesia. Their aim will be to pass through islands of the South Pacific and arrive in Australia or New Zealand in November. This marks the start of the cyclone season and consequent decline in offshore sailing.



Russ Spalding (W7MT)
Bend OR



Dick and Juanita McNish
(KB6USC) Somis CA



Tom Whelchel (WA6TLL)
Riverside CA



Bob Reed (N6HGG)
Arcata CA



Fred Moore (W3ZU)
Inverness FL



Larry Miller (W7CB)
Templeton CA



John Caine (VK4CEJ)
Laidley QLD



Don Anderson (N6HG)
Oxnard CA

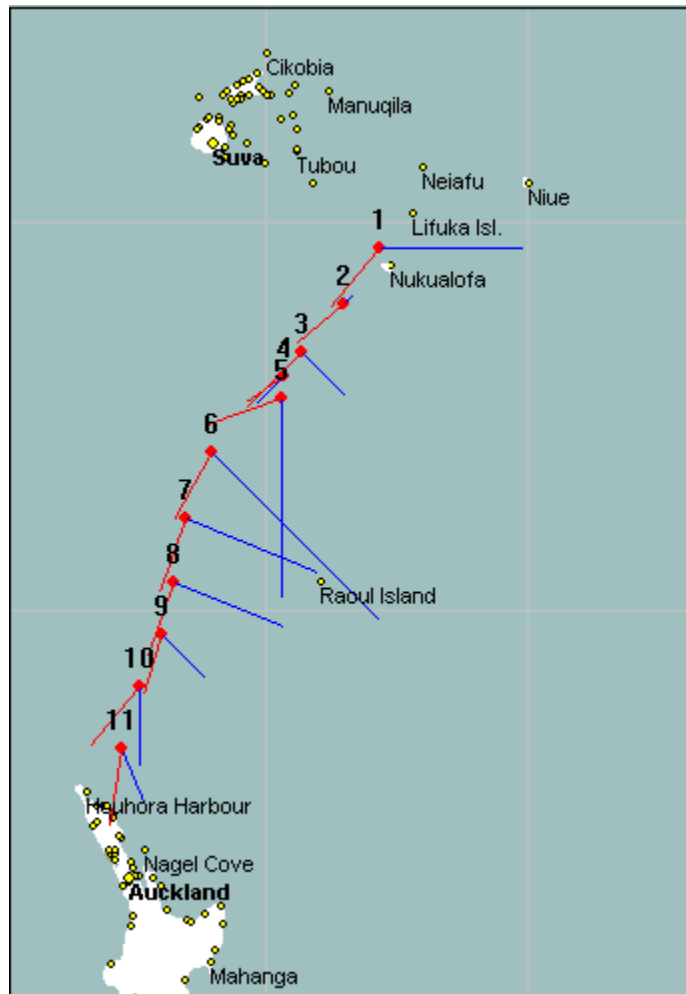
Some Pacific Seafarer's net control and relay station operators

Crossing oceans aboard a sailing boat can be a lonely occupation. As the days and weeks pass it can seem as though you are the only human life on the planet were it not for contacts provided by nets such as the Pacific Seafarer's.

In addition to providing a daily meeting point, the main business of the net is to collect position and weather reports from boats on passage which it does through a formally structured roll call. When called in turn, boats read out their current position and weather observations which are recorded by a net 'scribe' who types the details into a computer program. At the end of the session, the reports are sent by email to other net stations and to an internet service (YOTREPS) for further processing. YOTREPS is covered in more detail in the next section but provides check-in boats with a web page showing a plot of their progress on passage.

Track followed by single-handed sailor Russ Cobb (KK4MT) on his boat Hygelig en route between Tonga and New Zealand.

Red spots show his daily positions. The direction and length of the attached red lines are proportional to the boats speed and course. Blue lines indicate the direction from which the wind was coming and their lengths, the strength.



Sailing is a comparatively safe form of travel and accidents are not a common occurrence. However, extreme weather conditions, hull or equipment failures or medical concerns can lead to difficulties. At times such as these the Pacific Seafarer's Net has frequently provided backup support. On many occasions operators have kept open radio channels for hours and, by organizing shifts, sometimes for days on end. Many are experienced seafarers themselves and mindful of the need not to overburden yacht skippers with too much information or by calling too frequently, but the reassurance of knowing that someone is available when needed, is always appreciated.

The Pacific Seafarer's Net gets a good deal of publicity in the marine press and has a high public profile, receiving frequent messages of appreciation from non-amateur friends and relatives of participant boats. It is always on the lookout for Amateurs wanting to lend a hand as relay stations, controllers or scribes. The work requires a certain amount of training and familiarization with procedures, but no one is dropped in at the deep end and help and support are always available. The net's web site on www.pacsea.org gives more details of its activities and programs.

9. The Waterway radio and cruising club (WRCC)



Australia and New Zealand have few amateur marine nets. Participation rates are low and their survival hangs mainly upon the stalwart efforts of a few enthusiasts that have kept things unchanged for decades. Reasons for the falling numbers are given as the increasing popularity of cell or satellite phones or digital automated reporting schemes such as YOTREPS, or preference for marine frequencies where licensing requirements are less strict. All are debatable but on the US East Coast one net that has no shortage of participants is the Waterway net which is sponsored by the WRCC.

Formed in the 1960s, the WRCC claims to be one of the oldest in existence and has a current membership of around 1300. Its radio net covers the needs of boats sailing the intercoastal waterways and adjacent sea areas from the Caribbean to Canada and takes place daily at 0745 ET on 7.268MHz LSB. Net sessions are highly organized and include sections for emergency use, weather information, position reports, sailing plans and general chat.

A small annual charge is made for Club membership which is used to cover costs of printing and mailing the membership Roster, "Scuttlebutt" newsletter and the "Net Guide". Irrespective of whether they are members, all licensed amateurs are invited to check into the net. Its enormous popularity serves to prove that when organized correctly, marine radio phone nets can still provide a much appreciated service even in these times of cheap cell phones and marine email.

More details can be found on the net website www.waterwayradio.net

10. Position and weather reporting

The YOTREPS scheme is designed and managed by myself and provides ocean sailors with the following facilities:

1. A web page showing a chart plot of their most recently reported position.
2. Software for submitting and forwarding their reports.
3. Automated delivery of reports from other boats.
4. Automated delivery of selected weather forecasts.
5. Long term summaries of weather conditions experienced by boats on popular passage routes.

YOTREPS receives reports from a several amateur and non-amateur nets and directly from individual boats using a marine email service such as Sailmail or Winlink 2000 (see below). On arrival at the server, each is first checked for syntactic error and out of range data before saving it in an on-line data base. Once there it can be viewed by on the voyage tracker web page as in the Hygellig sample in the previous section.

Daily report summaries are also made available to other boats at sea. On a long passage it is useful to be aware of weather experienced by boats in weather systems that are ahead of you as a possible indicator of conditions to come. It is also useful to know courses and speeds of other vessels in your immediate vicinity so that the possibility of a close encounter can be assessed.

Reports submitted to YOTREPS also benefit the marine community as a whole. Even in these days of automated weather stations and satellites, manual observations still make a valuable contribution to weather forecasting. For many years ships at sea have regularly forwarded position and weather observation reports to metrological agencies through the World Metrological Organisation's (WMO) Voluntary Observing Ship Scheme (VOS). Trained crew, using standard instruments forward observations of a large number of weather parameters at regular intervals throughout the day. These contribute directly to the various world metrological models from which forecasts are prepared.

Because small craft are unlikely to have calibrated instrumentation, their observations are not used in numerical modelling but, instead, provide a reality check on their results. For example, the model may confidently indicate that a particular area will experience strong winds from an approaching front; its speed of approach and hence the time that this occurs may be less certain. In such cases, an observation of actual conditions can help pin down the speed and improve forecast accuracy. Privately owned small vessels substantially outnumber large commercial ships and often visit parts of the world away from the main shipping lanes and where there are fewer official reporting stations. For these reasons their reports can make a useful contribution to forecast accuracy.

In recognition of this the US National Weather service has established a special small craft weather reporting scheme known as MAROB to which YOTREPS reports make a direct contribution. Within moments of their arrival, reports are distributed to forecaster computer terminals around the nation.

Tim Rulon at the US National Weather Service in Washington DC alongside computer terminals used for processing marine reports.



11. Winlink 2000

In essence, Winlink 2000 is a system for sending and receiving email over HF Amateur radio frequencies, but this is an oversimplification as it has many additional facilities and advanced features that have yet to appear in equivalent commercial systems. In true Amateur radio tradition, Winlink 2000 was developed as a hobby project by professional engineers as a test bed for ideas and it has grown from there. Advantages of the system are:

- Independence. Can be run from a car battery and its operation does not rely upon the national power grid, telephone or satellites.
- Transportability. All components may be fitted into a suit case and are easily setup.
- Worldwide system. The nearest gateway into the Internet system may be located in another country, hundreds or perhaps even many thousands of miles away from the local user.
- Low cost. As an amateur service, there are no service charges. Equipment costs are comparable to that of a satellite phone.

On the other side of the coin, a point to be kept in mind is that the Amateur licence stipulates that frequencies are not used for commercial purposes. HF bandwidth limitations also mean that data speeds will always be very much slower than those achieved by regular telephone or satellite services. For this reason emails are strictly plain text only. That means no fancy fonts or decorated 'note paper', though small binary file attachments are typically sent without difficulties. These may be drawings, or spread sheets but acceptability depends upon connection speed. Typically, for a Pactor-2 modem (see below) this will be in the region of 800 bits per second, thus a 10K picture would take approximately 10 minutes to download. Occupying the system for long periods inevitably affects other users so big downloads are discouraged. However, since HF propagation is dependent upon ionospheric conditions, from time to time communications are made worse or substantially better by solar events such as flares or sun spots.

For users without access to regular telecommunications services, these points are not obstacles. Such users might include:

- Outback communities.
- Vessels at sea.
- Land travellers in remote regions.
- Disaster relief and emergency service workers.

Necessary equipment

The basic equipment needed to setup a mobile Winlink 2000 terminal consists of an HF radio, antenna, Pactor modem and computer.

Radio Winlink 2000 data transmissions are passed over regular voice channels so most currently manufactured HF Amateur or Marine Single Side Band (SSB) transceivers are suitable. Often they are designed with data in mind and include spare fixed level audio



input and output jacks and other sockets that make connecting to modems and computers easier. Older radios with poor frequency stability or those that can't switch quickly between transmit and receive, are unsuitable.

Antenna In common with other services that use HF, the antenna is a critical component. For those who understand the principles involved, a simple dipole strung between trees or an insulated length of rigging wire can be very effective. Commercially produced whip or beam antennas are another option but unless the antenna is correctly matched to the radio and frequency in use lack of signal strength is likely to make communications difficult.

Pactor 3 modem Pactor is the name of the protocol that is used to send data over voice channels. Over the years there have been several variants of Pactor but 3 is the most recent and, although the system still supports earlier versions, they should not be used for a new installation. About the size of a pack of sandwiches, the device is a self contained computer and digital signal processor that carries out the task of encoding text as audio tones and conversely decoding audio back to text.



Such modems, sometimes known as data controllers or Terminal Node Controllers (TNCs), are not difficult to install, having only a connection to a power supply, computer port and audio output and microphone inputs on the radio. Superficially, they appear to have few controls but most adjustments are done by software commands from the computer giving them great versatility and the ability to handle a variety of other codes and protocols (eg morse, telex, weatherfax) in addition to Pactor.

Computer: Since most of the signal processing is carried out by a modem, the purpose of the external computer is mainly just to provide a keyboard and screen to monitor and control operation of the modem. For this reason, demands on the computer are quite modest and it doesn't need to be particularly fast or have lots of memory. Often an old machine will do though most modem access programs are written for Windows so it should be able to run a current version of the operating system.

The software that is generally used to control the modem and radio and to provide the user with message boxes for sending and receiving emails is Airmail. This has also been developed by an Amateur (Jim Corenman) and is available as a free download from www.airmail2000.com

Recent developments: SCAMP (Sound Card Amateur Message Protocol)

As a proprietary code, marketing and development of Pactor equipment is the intellectual property of its originators at SCS (Special Communications Systems GmbH & Co Germany). Costing several hundred dollars, modem costs are a burden for many potential users which, along with the need to have control of the standard has motivated some Amateurs to look for public domain alternatives.

Most computers these days include a sound card for processing audio signals and which already has connection jacks for audio output and microphone input. In principle, one only needs some suitable software to carry out the encoding and decoding functions and the entire job of the Pactor modem could be carried out

aboard a PC. This approach is not new and is already used by a number of programs to process, slow scan television, weatherfax images, and the various forms of telex (for an example see www.jvcomm.de).

Unfortunately, most current non-proprietary data codes lack an adequate error correction or speed versatility needed for efficient transfer of email traffic over HF. However, as a replacement for Pactor, Winlink 2000 development team member Rick Muething is working to perfect a high performance alternative known as SCAMP. Other codes such as CONTESTIA and a modified PSK63 are also being examined. At the time of writing, test trials have been conducted, prospects look good and it is hoped that a release version will be available within the coming year.

Since this would involve the computer in real-time signal processing, a higher specification computer than that required to drive a modem would be needed. Certainly, it would need a suitable sound card, though Rick reports that in addition to the computer a 1GHz Pentium processor with minimum of 512Mb of RAM would be sufficient.

Sending and receiving emails via Winlink 2000

As mentioned earlier, Airmail provides the interface through which users send and receive emails. It is directly comparable to other familiar email software such as Microsoft Express, Outlook, Eudora etc. These may also be used with Winlink 2000 (see later), but a major difference between using an HF radio link and regular dialup or broadband connection is that one only connects for the time needed to download any pending incoming messages and to send those that have already been written and queued off-line.

The send/receive process proceeds as follows:

A) After starting the computer and radio, the first step is to establish a Pactor data connection to an available Winlink 2000 Participating Mailbox (PMBO) station. These are computer controlled HF radio stations, comparable to the Echolink stations mentioned earlier, but using email instead of voice messaging. PMBOs have been established in many countries around the world. Their frequencies, times of operation and beam headings are published but the choice will depend mainly upon radio propagation conditions and availability for use.



B) Queued messages are sent to the, PMBO computer where they are picked up by their respective recipients. Messages waiting to be received are stored on the PMBO computer and are sent to the user.

For the user, the session ends at this stage but for the Winlink 2000 system there are a number of house keeping jobs to complete. Firstly, incoming messages when picked up by the user are automatically deleted from the PMBO being used as well as every other PMBO that the user may have chosen within the last 90 days since last used.

Management of messages is handled by another layer; the Common Message Servers (CMS). The CMS also filters spam and protects users from malicious attachments. The user can control spam options which can be set remotely.



Rick Muething (KN6KB)



Vic Poor (W5SMM)

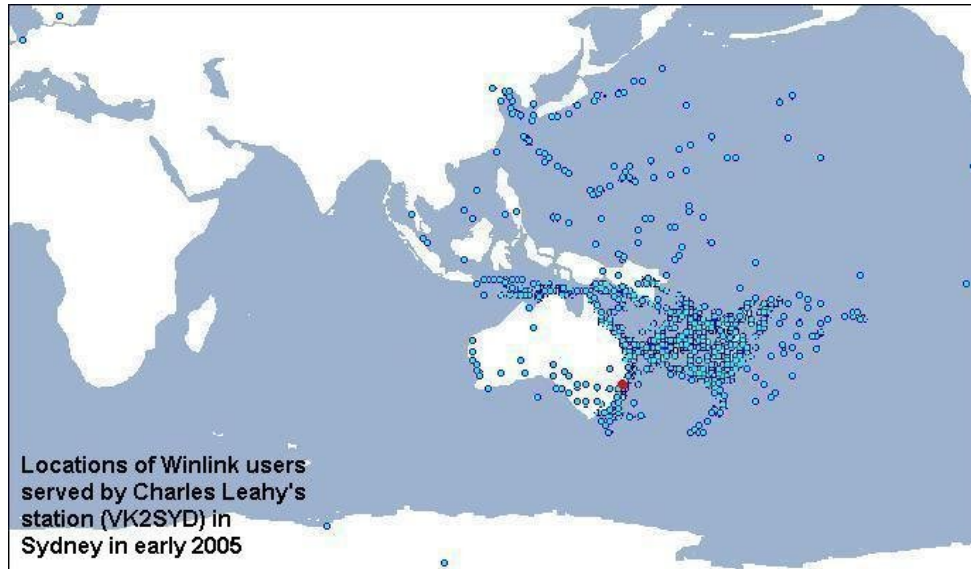


Steve Waterman (K4CJX)

Several members of the WinLink development team

Opportunities for Australia

Following recent changes in the licensing conditions, Australian Amateurs are now permitted to establish PMBOs within the country. As well as covering the continent, Australia's important strategic location enables them to provide Winlink 2000 email services to large parts of the Pacific, Antarctica and Indonesia. The following plot makes this point well:



HF propagation knows no boundaries. Note the many contacts in countries such as New Zealand that have their own established PMBOs. HF radio works best over distances greater than a few hundred miles so connection via a PMBO in another country may often be easier than connecting to one in your own. Once a Winlink 2000 PMBO is established it becomes available for use by all sections of the community. As an example, users of Charles Leahy's Sydney station include 4 wheel drive travellers in the bush along with boats in the Pacific and small island residents.

Sailing Club PMBOs

For some groups, the benefits of Winlink 2000 are so significant that they have generated the motivation for an active participation in Amateur Radio. In Australia however, although boating, sailing and marine organisations encourage education in the use of marine radio, Amateur Radio is seldom considered at present.

In contrast, a number of sailing clubs in the US have established their own PMBO stations which operate alongside their regular marine band radio communications. The California Yacht Club is but one example. Managed by Scott Stolnitz(K6CYC) this station provides a service not only to club members but also to a broad community of users in the North Pacific and US East Coast.



Radio shack at the California Yacht Club at Marina del Rey, Los Angeles



PMBO corner. The HF radio and Pactor modem can be seen above the mouse pad. Behind is a speaker and antenna tuner and to the left is the main computer.

Winlink 2000 and the emergency services

As a basic principle, the US national body, the Amateur Radio Relay League (ARRL) place great importance on encouraging ways in which Amateur Radio can provide community benefits through public service. This is evident from the many nets dedicated to relief operations and structured organisations that exist at local, state and federal level for managing various aspects of emergency communications. These include:

- Amateur Radio Emergency Service (ARES)®
- Radio Amateur Civil Emergency Service (RACES)
- Military Affiliate Radio Service (MARS)
- Salvation Army Team Emergency Radio (SATURN)
- Hurricane Watch Net
- SKYWARN (weather reporting net)

Through a number of its own publications the ARRL has worked to ensure that volunteers assisting in emergency operations adopt high standards of professionalism and are able to work effectively alongside other professional agencies such as the police, ambulance or fire services. To this end they have produced the "Emergency Communication Handbook" and "Amateur Radio Emergency Communications Course" This is a three level course designed to develop skills and present a range of communications tools that can be built upon to match specific community needs.

During natural disasters such as earthquakes, hurricanes, cyclones, floods etc, public phone lines and power utilities are usually among the first casualties. At the same time demand for these services increases and simple "are you ok?" type enquiries can overwhelm what remains, leaving no capacity for requests for assistance.

It is in situations such as these that Winlink 2000 is especially useful. By linking through services in other countries, local disruptions are circumvented. In the case of the 2004 Boxing Day Tsunami, the two Australian PMBOs both reported large increases in traffic to affected areas. Two months later, John Goda (VK8HF) in Darwin reported that his PMBO was still handling greatly increased traffic to stations along the Thai-Malaysian peninsula and affected Indian Ocean archipelagoes; an indicator that many cruising boats had remained in the area and were providing local assistance to victims and relief workers. This same assistance was made available throughout the Pacific when a major communications satellite, INTEL 804 failed.

“Last mile” coverage – VHF and UHF Winlink 2000

Winlink 2000 was already a robust global messaging system but to improve its utility as a system that could be used by emergency recovery managers, two important points needed to be considered:

a) “The Last Mile” To communications engineers, this is a term that refers to the final link between individual local homes and agencies, and the local exchange or data hub. It consists mainly of a network of copper cables sometimes buried in the ground but often strung between roadside poles. Built up over decades, this infrastructure is the most difficult and expensive to replace. Winlink “hubbing” PMBOs will replace Internet links when such local links fail.

b) Compatibility with familiar software. All of us who use computers regularly are familiar with the difficulties that can be experienced in learning to use new software. To have to do this while managing a civil emergency would be intolerable. For effective use by emergency workers, the system must transparently and seamlessly use software and procedures that the operators are already familiar with. As an email messaging system, Winlink 2000 needed to be able to use industry standard de facto email software items such as Microsoft Outlook Express, Outlook, Netscape or Eudora, all items with which the vast majority of regular email users would already be familiar.

To address these issues, two pieces of key software were introduced; ie Telpac and Paclink.

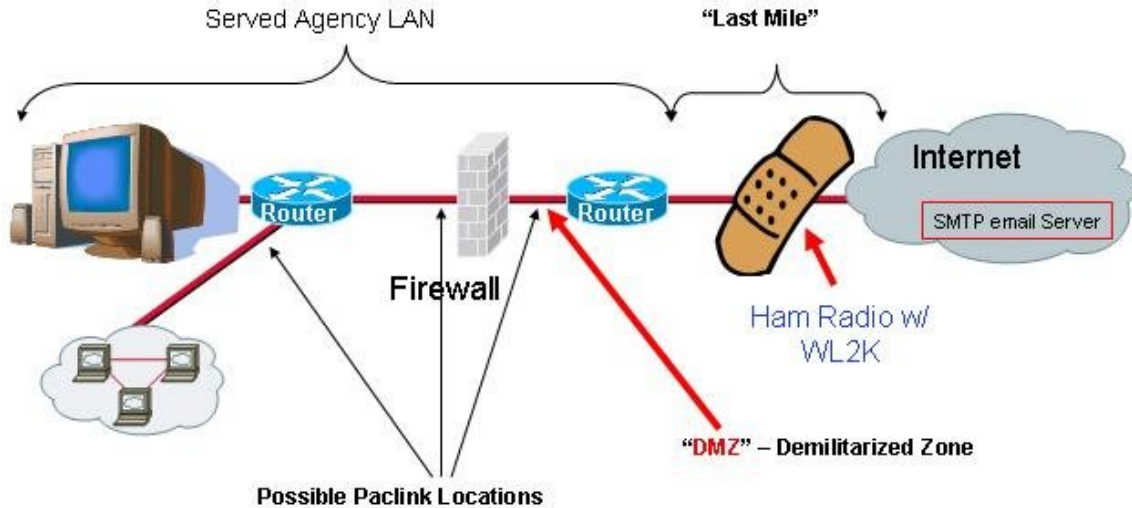
Telpac

Unlike HF, a characteristic of VHF and UHF signals is that they are effective over short line of sight distances only. While this may seem like a disadvantage, it also means that transmissions can be made between stations in one locality which will not interfere with those in another even if they use the same frequency. VHF and UHF frequencies are ideal for covering local last mile links and for at least two decades have been used by amateurs to provide local messaging services though a system known as Packet radio.

Telpac is a software tool that creates a bridge between local Packet radio data networks and a remote Winlink 2000 PMBO. Responding to what services are available, Telpac makes the connection via the internet or wireless data connection such as 80211 or ICOM Corporation’s D-Star.

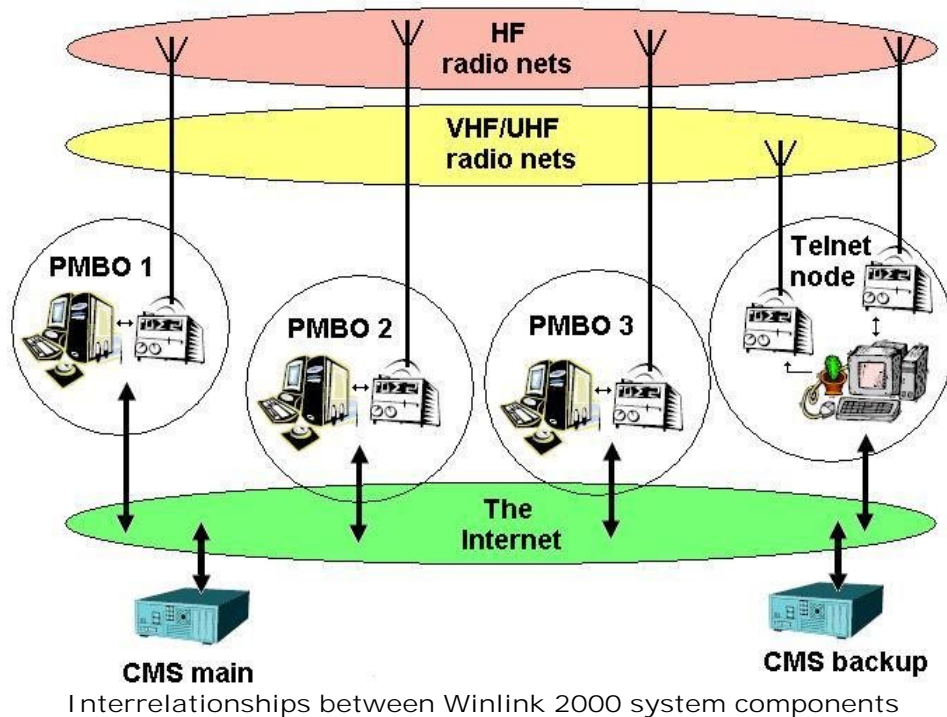
Paalink

Paalink is the tool that allows use of familiar client email programs. Working with local Packet networks and placed behind a router but sometimes in front of the firewall (DMZ), it can enable single or multiple computers to access local packet networks for sending and receiving emails. It may do this as any other email server, without any additional software on the computers on the LAN using it.



"Last mile" connectivity

With Paalink and Telpack, Winlink 2000 forms part of a worldwide messaging network. The internet is used to speed data transfer and freeing up the valuable but limited HF radio bandwidth. However, should parts of the internet fail, the system has the agility to switch to radio routes and thus maintain a service of high integrity.



Interrelationships between Winlink 2000 system components

WinLink 2000 services as part of a county emergency communications plan

Williamson County Tennessee is one of a several US administrations that have adopted Winlink 2000 as part of their emergency communications network. Great confidence has been placed in its integrity and reliability, and it thus forms an integral part of their overall communications plan by providing seamless cover for internet failures. The following pictures tell the story.



John Allman radio amateur and Technology Director at Brentwood city (TN) alongside their Winlink PMBO



Computer racks housing the Williamson County PMBO



WC4EOC Amateur radio station at Williamson County



Phyllis Phillips, dispatcher at the 911 emergency centre routinely handles calls for police, fire and ambulance services.

Fitted with PaLink her computer terminals are equipped to cover failures in conventional telecommunications services.

12. The Hurricane Watch Net

Created in 1965 the Hurricane Watch Net is concerned with hurricanes occurring within the Atlantic, eastern Pacific, Caribbean and Gulf of Mexico. Operating on 14.325MHz it becomes active when a population is threatened or a hurricane is within 300 miles of its expected landfall. The net consists of a group of trained licensed Amateur Radio Operators who work in close co-operation with the National Hurricane Centre (NHC) in Miami FL through its own Amateur Radio station (WX4NHC). Their principle objectives are:

1. To ensure that people in affected areas have current forecast data.
2. To provide NHC forecasters with weather reports from trained observers. As with YOTREPS reports, this enables them to further refine their forecast predictions.



Locations of Hurricane Watch Net stations in 2005

During times of hurricane activity, the net's web site (www.hwn.org) provides frequently updated satellite views of weather systems and affected areas. As a public service this is extremely popular. For a period during hurricane Ophelia, hit rates were measured at 1.4 million/minute.

As a long standing net with established credentials the Hurricane Watch Net has become an integral part of the national hurricane strategy. Each year it sends delegates to the 5-day National Hurricane Conference where information is shared and national policy formulated.

Mike Pilgrim (K5MP) has managed the Hurricane Watch Net for the past 5 years



13. The Seven Seas Cruising Association (SSCA)

The SSCA is a not for profit organization formed in 1952 by a small group of live-aboard cruisers in California. Their idea was to share experiences and knowledge through a monthly magazine. Today this is still the objective, though membership has now grown to about 10,000, and includes many cruisers from other countries. Now based in Fort Lauderdale, Florida, and as an aid to newcomers, the SSCA hold regular day-long seminar sessions at various locations around the country. Known as Gams, though no one could tell me why, these events have become enormously popular and regularly attract over 1000 attendees, many arriving by boat. The annual Conference, held in Melbourne, Florida, coincides with the Annual get-together of the Waterway Radio and Cruising Club which is made up of 2000 amateur radio and boating enthusiasts. Many who attend are members of both organizations.

At the one I attended in Annapolis, which coincides with the United States Sailboat Show, several days of solid rain did not deter the more than 400 members and guests from attending. In spite of the mud, the event had an enthusiastic, festive air as delegates learnt some of the skills needed to survive as an international voyager.

Because members are likely to disperse to other parts of the world for long periods, communications issues are usually high on the Gam agenda. They regularly include sessions on Winlink, email and other aspects of Amateur Radio that play an important part in holding the Association together. It is through these channels that the group makes social contacts, and exchanges articles and ideas. In return, the SSCA continues to actively promote Amateur radio by facilitating courses, exam sessions and supporting Winlink PMBOs.

14. Automatic Position Reporting System(APRS)

APRS is a radio tracking scheme that can be used to track the positions of cars, ships, boats, walkers, marathon runners, balloons, stolen vehicles or pretty well anything that moves. Position data obtained by Global Positioning System (GPS) receivers is transmitted via a HF, VHF or UHF radio, Amateur satellites or the Internet to a data base where they are stored. Various web sites (eg www.findu.com) and web driven software exist that allow positions to be plotted on maps or charts that can be tailored to meet specific needs. APRS is not new to Australian Amateurs. Several have built gps/radio modules for vehicle tracking and similar applications.

For the Fellowship project, my main interest in the system was the possibility of using it for forwarding YOTREPS style position and weather observations from boats at sea and it was with this in mind that I spent a day with the systems originator Bob Bruninga (WB4APR) at the US Naval Academy in Annapolis.

During our meeting Bob explained details of the system in depth, and pointed to ways in which its message structure could be adapted to include additional weather parameters of the type required by YOTREPS and the National Weather Service MAROB scheme. We also touched on closer co-operation between APRS and Winlink and since our meeting, the Winlink team have announced the release of APRSLink a service that allows APRS users to:

- Read short e-mail messages sent to their Winlink email account.
- Send short e-mail messages to any valid e-mail address or Winlink 2000 user.
- Perform e-mail related maintenance.
- Receive an APRS message notifying them of any pending Winlink email messages.
- Query APRSLink for information of their nearest Winlink interface (ie Telpac gateway or PMBO).



Bob Bruninga (WB4APR)

15. Conclusions

A traditional view of Amateur Radio is that it should be concerned solely with technical experimentation in communications techniques. A couple of decades ago, it was common for Radio Amateurs to build much of their own equipment but in recent times several factors have combined to thwart all but the most resolute home constructors. The primary cause has been the greatly increased number of users that now compete for space on the radio spectrum. Examples include radio and TV broadcast stations, cellular phones, aircraft, police, military, radio astronomers, and even garage door openers. To accommodate more users means using lower bandwidth communications equipment which, in turn, is more complex and through the use of microelectronics, more difficult to build, particularly on the kitchen table level.

As home construction became less of a practical proposition, and the thrill of being able to talk to someone on the other side of the planet became something anyone could do over the Internet, so numbers of licensed amateurs fell. Without new directions and a fresh look at the entire field of amateur activities, it seemed possible that Amateur Radio might fade into oblivion and its valuable blocks of spectrum be sold off to the highest bidders.

In contrast to Australia and the UK, Amateur radio in the US has had a long association with public service. Helping communities is a major part of many activities though this need not, as some have suggested, lead to a dumbing down of technical standards required for the licence. True, Morse code no longer plays a prominent part in modern communications technology and it is appropriate that it should have been dropped as a compulsory syllabus item. It is also true that building equipment by soldering components on circuit boards is no longer a mainline activity, but then other high level skills are still required to design, build and maintain communications systems such as those described in this report. Knowledge of how to assemble circuits from discrete components has been replaced by knowledge of programming techniques, software development and use of communications codes other than Morse.

"So we stand at the door of an important new stage in Amateur Radio. If we wish our hobby to survive, then we need to (get) a new generation to join us", said Colwyn Low (VK5UE) in an editorial in the Wireless Institute magazine "Amateur Radio" (October 2005). He was writing specifically about the new Foundation Licence but the wider message is clear enough. In the USA, public service related activities such as those outlined in this report have been enjoyed for decades. Through high levels of training and professionalism, the extent to which Radio Amateur volunteers have been able to effectively assist during times of regional disasters is often well reported by the media which, in turn, helps encourage recruitment. Provided we remain open to change there is a bright future for Amateur Radio in Australia; one that will also bring benefits to communities that probably have yet to hear that it exists.

16. Recommendations

Improvements that I can help bring about include:

- Further spreading information about the relevance of Amateur Radio to marine users at cruising and sailing seminars, yacht clubs and Amateur Radio groups.
- Utilisation of technical information given by Bob Bruninga that would enable the use of APRS for forwarding position and weather reports from vessels at sea.
- Utilisation of technical information given by Vic Poor that would enable more efficient use of Winlink resources for YOTREPS reports

Improvements that should be made in Australia include

- A detailed investigation of the contribution that Winlink can make to emergency communications along the lines demonstrated by Williamson County TN and the ARRL's Emergency Course and Handbook.
- Marine radio courses to outline the roll that Amateur Radio plays and how it fits into the radio spectrum.

17. Further information

Web URLs

Airmail. See also the pactor primer from the same site.	www.airmail2000.com
Amateur radio participation statistics	www.ah0a.org/FCC/
Amateur radio statistics	www.ah0a.org/FCC/
Aussiewinlink	www.aussiewinlink.org
EchoLink	www.echolink.org
Hurricane Watch Net	www.hwn.org
National Hurricane Center	www.nhc.noaa.gov
Pacific Seafarer's Net	www.pacsea.org
Pactor modems	www.scs-ptc.com
Radio net for the US east coast intercostal waterway	www.waterwayradio.net
Seven Seas Cruising Association	www.scca.org
Sound card software	www.jvcomm.de
Williamson County Amateur Radio Emergency Service Plan	www.wc-ares.org/files/printable_wc-ares_plan.pdf
Williamson County Emergency communications centre	www.williamson911.org
Winlink 2000 pages:	
Home:	www.winlink.org
Publications:	www.winlink.org/news.htm

ARRL Publications

Title	ISBN
The Emergency Communication Handbook	0-87259-938-8
Amateur Radio Emergency Communications Course Levels 1 to 3	

Acronyms

ACMA	Australian Communications and Media Authority
APRS	Automatic Position Reporting System
ARES	Amateur Radio Emergency Service
ARRL	Amateur Radio Relay League
CMBO	See CMS which replaces this term.
CMS	Central Message Server (A Winlink term that refers to internet servers that manage messages at PMBO stations)
GPS	Global Positioning System
HF	High Frequency (Frequencies between 3MHz and 30MHz)
LSB	Lower side band

MAROB	Small craft marine weather observations (www.weather.gov/om/marine/marob.htm)
MARS	Military Affiliate Radio Service
NHC	National Hurricane Center
NTS	National Traffic System
NWS	National Weather Service (US)
PMBO	Participating Mailbox Servers (A Winlink term that refers to radio/internet gateway stations around the world)
RACES	Radio Amateur Civil Emergency Service
RSGB	Radio Society of Great Britain
SCAMP	Sound Card Amateur Message Protocol
SSB	Single Side Band
UHF	Ultra High Frequency (Frequencies between 300MHz and 3000MHz)
VHF	Very High Frequency (Frequencies between 30MHz and 300MHz)
VOIP	Voice Over Internet Protocol
WIA	Wireless Institute of Australia
WL2K	Winlink 2000
WRCC	Waterway Radio and Cruising Club
YOTREPS	Yacht Reports – a reporting scheme used by boats on ocean passages that plots their progress on an internet chart and provides forecasters with weather observations.