

DISASTER COMMUNICATIONS

PART 1 GLOBAL

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Disaster Relief Communications Foundation

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CHAPTER 1

1.1 INTRODUCTION

The fact is, without communications, you don't have an organisation, you have a disorganisation.

Everyone involved in disaster, aid and allied voluntary services is aware of the huge waste and nuisance caused by poor communications in the field. Time is wasted driving around looking for staff and equipment. The rapid deployment of the right equipment in the right place at the right time is impossible. Managers can have no idea what is happening once people leave their sight. Without eyes, ears and a voice, they are just by-passed by the staff at the front end of the job. The staff in the field know there is no back up, no help coming from outside, and would rather valiantly improvise than spend days in a possibly fruitless search for help.

The ease of communication in a developed city is seductive, so much do we take it for granted that it becomes like the wallpaper in the office (no cheating, do you remember the pattern?). It is a serious but common mistake to underestimate the complexity and importance of communications, that is why The Disaster Relief Communications Foundation (**DRCF**) continuously researches and reviews the whole matter, calling on expert opinion to keep their advice up to date.

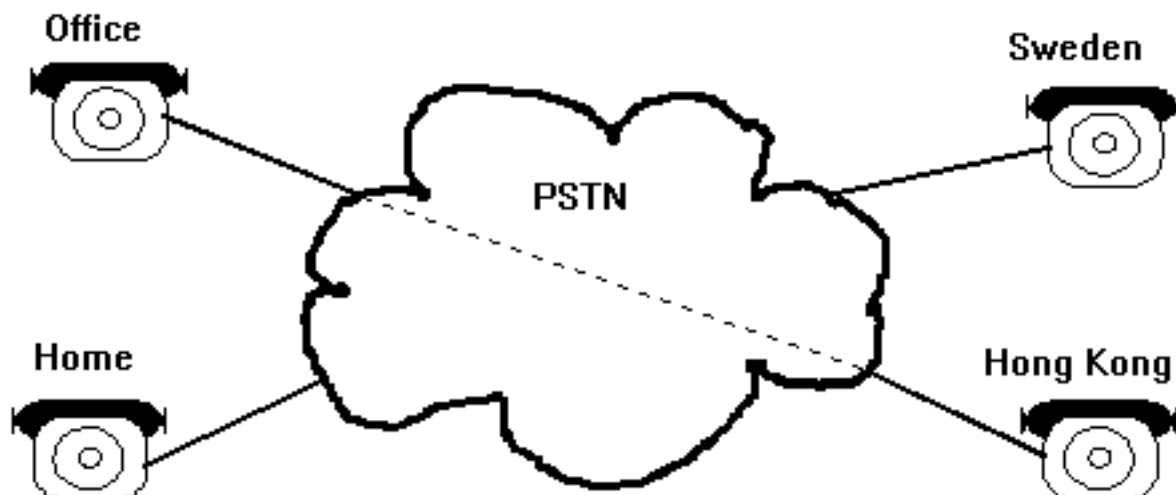


Fig 1 The Public Switched Telephone Network (PSTN) is the largest single structure ever made by man.

Communications may seem like only a third world problem but, even urban areas will find their normal (Landline) phones via the Public Switched Telephone Network (PSTN),¹ Mobile Phones² and Telex systems out of action in the case of most types of disaster because the cables may be damaged or there may be no mains to power the telephone exchanges.³ A perfectly working PSTN system is usually designed so that no more than 5% of the phones connected to it, can be talking at the same time. During a crisis, there may be too much traffic for it to handle, and so it will become overloaded, so you will keep getting unhappy sounding tones when you try to dial. It is not even safe to take 'landline' services for granted in some locations of operation as they may be rather poor or even non-existent.

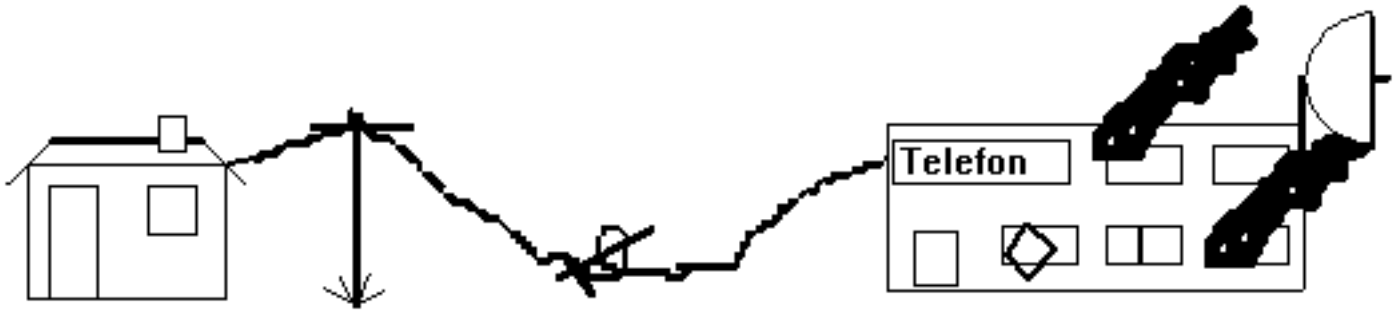


FIG 2 The PSTN actually depends on telephone exchanges and lines on the ground which are vulnerable in times of crisis.⁴

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Cyclone "Hollanda", Mauritius, February 1994. To prevent wind damage, the satellite dishes at the earth station had to be parked in a horizontal position, they could not then point at the satellite and thus all international communications to or from the island state was cut off. Despite these precautions, it took three days to repair the damage, in the mean time, it would not have been possible to summon help from outside. Technological and commercial pressures are causing more centralisation of critical network elements, leading to their vulnerability in times of crisis.

So we must take our own communications that don't depend on any lines or power from the area. We also need something that can be set up in a few hours, anywhere in the world, with no previous notice or time to plan elaborate engineering. The solution must also be portable enough to be quickly moved into position by a small number of people, who will be too busy to spend hours with complex technology.

Most important, it must be **affordable** to the organizations sponsoring the relief effort .

The subject of **Local** or Tactical communication, short range communications between the team members or a local cluster of camps for example, is a separate one. This has been given consideration in part 2 'Disaster Communications- Local'

I will try to mention just about every practical system we at DRCF have ever heard of. Just because we mention (or don't mention) a system, **this is not an endorsement of the idea**. We merely acquaint you with the facts and leave you to decide what you think is best for you. Reading this won't make you an expert, but it will help you and your experts to come to a better understanding

The Disaster Relief Communications Foundation (**DRCF**) is a Non Governmental Organisation (NGO), a small registered charity, and we admit that our resources are limited. However we do try most conscientiously to make sure that what we say is generally agreed to be true, or at least valid opinion, by experts in the relevant fields. However if you know of something better that we do, we

most sincerely welcome input, for future revisions of the book.

The powerful image of Captain Kirk nonchalantly pulling his communicator from his belt and effortlessly contacting anyone anywhere is not just a dream. By the turn of the century, systems like IRIDIUM, GLOBALSTAR, ICO, Teledesic, Ellipso, Odyssey, Constellation and many more, will bring just that and give hand held mobile phones that really work anywhere in the world. Then, there may be less need for books like this as there may be one obvious way to communicate with anyone anywhere, but as this service will not be available until 1998 at the earliest, and it's effectiveness is as yet unclear, we will consider those services available for our purposes at the time of writing.⁵

There are two methods.

- SATELLITE SYSTEMS, (we will talk mostly about the INMARSAT system)
- H.F. RADIO, (we will consider Private radio, Marine radio, Gateway and Amateur radio)

1.1.2 What Is 'Disaster Communications'?

The needs of disaster communications and aid communications are in some respects similar, but the operational needs of the two distinct types of organisation are quite different. This document is about disaster communications, but the information is applicable to aid users also, provided the differences are understood.

It is the target of disaster communications units to be on the scene of the callout not later than 24 hrs after the first alert. This sounds like plenty of time, until we remember that the personnel involved are Volunteers ⁶, who first need to be contacted by various means, usually by phoning around by their group leader. Then their employer may need to be contacted to get permission to be absent for the next two or three weeks and family business re-organised, grand parents found to look after the children, clothing and equipment packed etc, all with the phone ringing like mad as the team is assembled.

***Author's note:-** These definitions for disaster, aid and Emergency communications are my own invention, for use only in this document. Official definitions vary, but the UNDHA prefer the term "communications in the Acute Phase of an emergency" where I mean disaster communications. and "Long term Emergencies" where I use "aid". Normally there is no separate definition of "Emergency Services" made in legislation. By this I will mean state run and funded organisations. The word "communications" can mean forms such as Broadcasting and other media. For point-to-point communications, the term "**Telecommunications**" is preferred.*

Meanwhile, a deadline emerges, a transport plane must take off with the men ⁷ and supplies, and with only about four hours to spare, the equipment must be found from its storage place and brought to the mustering point. There is no time to test, no time to plan and certainly no time to train on complex technology.

This can be done only if the specialised teams have already got everything organised well in advance. The team members must be sufficiently familiar with the equipment, that once in the field, they can repair anything not working, or more usually, improvise things that somehow didn't make the deadline. They won't know how busy they will be, who and how many teams of what nationality they will serve, or for how long.⁸ Networks will have to be created as they go.

A successful operation can only be achieved if the hardware taken to the field will certainly work without prior planning or engineering and if the staff are professional and self reliant.⁹ Planning is impossible because the team would have no way of knowing where they are going in advance, or what existing systems may be still working on the site, or if anything is available at all, even electricity.

On the plus side, the operation can be expected to take about 1-4 weeks, so a temporary or makeshift installation is quite satisfactory and elaborate permanent systems designed to be in place for months or years are not needed. Also, some governments waive or shorten the licensing and Import duty requirements for the equipment, (if you remember to ask nicely).

Finance is a tricky question, from where and when the expenses will be met is often unknown.

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In one case, a small British NGO found their Inmarsat-A sat phone to be the only working communications at the site of a disaster. This soon attracted attention from desperate officials from other organisations to borrow it for 'one quick call'. On return to Britain, the bill was beyond their resources to pay, and it was very difficult to prove who should pay what, the result being very unfavourable for the NGO. The resulting severe financial strain nearly destroyed the whole organisation. Fortunately they survived wiser but much sorrier. If people borrow your communications facilities then make sure you know who they are, how much they owe you and how and when they will pay. This goes for your own people too, Satcomms is highly intoxicating, you must tell your client when he has had enough and close the bar!-IRC

1.1.3 Differences to 'Aid' Communications

By contrast, aid organisations usually have weeks or months to plan their operations and have a good knowledge of where they are going and what to expect when they get there. They even have staff in place to carry out the operations needed, and also budgets in hand to finance expenses arising.

This means that proper planning and even surveying can be carried out before installation so that a well engineered installation can be done. Networks can be devised, and the recent history of the operation will guide as to with whom and how to communicate.

It makes no sense to have permanent Radio Officers¹⁰ dedicated to communications in a refugee camp (unless traffic levels are high), so after installation, training of the staff who will use the equipment and become Radio Operators¹¹ or just casual users is most important.

The installations will be likely in place for some years, so a durably engineered solution is needed. Also the correct permits and licences from the host government will be needed by such an installation.

1.1.4 Emergency Services communications

In this book, I will not mention 'Emergency services' communication much at all. By Emergency services I mean such as the local Police, Ambulance Service, Fire Brigade, Civil Defence, Army etc. These organisations have their own existing communications system and networks. It is most likely that they will be working in their usual territory, so their normal VHF or HF radio system will be in range. These will however be supplemented by additional mobile control rooms, reporting centres etc, but again they will be using their own equipment kept in reserve for emergencies. Statutory emergency services will also have many full time technicians on call to set up and run their networks, so they are unlikely to have very big communications problems.

Experiences show that statutory services are highly self contained. Sometimes however, this has the down side that they may not be trained to see the need to help you by providing equipment or air time on their network. Also their networks will be configured to funnel information to their own control centre rather than the PSTN, so even if they do let you use their radios, you will only be able to send messages to their HQ. Maybe they will be happy to pass messages on for you but maybe not. This will depend on the attitude of the government of the state you are operating in and if a UN OSOCC is operating.

You may find it difficult to communicate with their networks and may find them hostile to anyone trying to do so as they are trained to ignore any call sign that is not on their briefing list. The best policy is to depend on your own network and let your organiser speak to theirs on a peer-to-peer basis to organise a means of communication with them.

A further problem may be language. If you are working with teams speaking another language than yours, protocol may require that you work through an interpreter at high level in their organisation.

1.2 WHAT DO WE WANT?

Knowing the type and amount of messages you will want to send and to whom is the key to deciding which of the many systems to use, so let's briefly look at some of the factors in choosing the message types.

1.2.1 FOR PHONE

Most NGO workers I have asked (who were not communications experts) have expressed a preference for voice communications and by that they mean phone calls via the PSTN. The phone has much to commend it. Giving two way, 'live-as-it-happens' conversation ¹², means that problems can be discussed and many alternative ideas brain-stormed in one conversation. It also has the advantage that the caller has the psychological reassurance that the person he¹³ wanted has heard and understood the meaning of the message and besides, hearing the voice of a person you know is very warming.

Furthermore there are phones everywhere in the world and it is highly likely that the person you are calling has one at home should he be there. It is also the best way of reassuring relatives at home that you are well and happy in your work, and putting their anxieties to rest.

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Do regularly call your sponsors and family. Just 3 Min. every week or two is enough to hear your voice and won't cost much.¹⁴ Don't make a date or 'sked' you can't keep, as not hearing from you when expected will make your family literally sick with worry. If overdue, get a message via someone somehow so that they don't worry. If you are asked to pass on an 'I'm OK mum' message from someone you meet, make sure that you do.

1.2.2 AGAINST PHONE

On average, phone calls are a very inefficient way of communicating specific technical information, facts, tables of abstract figures and numbers etc. We must realize that a phone can ring just one other phone in the world. You the caller must know the number to dial, taking the risk that there is a person to answer that phone and that the person you need is near to the phone that you have just dialed. Sometimes the voice from the mobile station, whether by SSB radio or satellite may sound very

strange to the new listener. Things may be awkward if the called person is not used to the simplex procedures or digitised voices with long echo and delay.

We are expecting the person at the other phone to drop what he is doing now and rush over to the phone, hopefully with pen and notebook in hand, and be able to answer your questions 'off the top of his head'. One problem is that the person you are calling is sure to be very busy, but you have no way of knowing if your call is more urgent than what he is doing right now. If he cannot answer questions now, we are relying on him to make notes detailed enough and accurate enough to contain all the information he needs to find the answer, then rush back to the phone with the reply.

Time is very important here as a satellite phone call may cost up to USD 8.00 per min. you can see that only 5 min. of wasted time costs USD 40! Even if the person is not there at the time and someone else takes notes for you to pass them on, we are relying on someone being in the office at the time, and making notes in handwriting clear enough for someone else to read, then finding the time to remember to pass the message on.

Another big problem is that of working across time zones. If you are wishing to call a person from their office number, they may have a 24 Hr watch, or they may be available only during office hours in their country. It may be that you are much too busy at this time, on the move and out of communication, or only have a small window of time to be available for communication yourself. The solution is to call the person at home, but first you must have the number and the person's permission.

1.2.3 For Text

By a text message I mean a written message containing only letters of the alphabet and numbers. An example of a text message is a telegram or a Telex but also includes Electronic Mailing. The advantages of communicating by text are many. For example, the sender¹⁵ does not have to worry about the availability of the person to whom the message is to be sent (the addressee), because the message can be passed on later.

Time zone and office hours problems are no longer a concern as the message can be sent at a time convenient to the sender. This is important as the sender will have his work set by the demands of the field, or probably be traveling much of the time and only be able to set up and use communications equipment when an opportunity presents itself.

By sending a text message, the sender can go through the ordeal of setting up his system when he feels he is ready to do so. The information can be compiled off line in a personal computer¹⁶ in advance and 'beamed up' when ready. The sender is forced into the discipline of compiling his message in a logical order and presenting it in a meaningful way. The sender also has the opportunity to edit and review the message before it is sent. Just as important is the need to formulate accurately. This prevents the quite serious problem of inundating the addressee with lots of details and incoherent 'odds-and-ends'. As my grandfather, who was a craftsman, used to say, measure it twice, cut it once.

The sender can have the fullest confidence that the addressee or addressees have an accurate 'hard copy' (on paper) of the full text sent rather than a few scribblings of what someone else gleaned from a phone call and that as the message is copied and circulated, it will not be distorted as it is passed round.

If the people in the field have the luxury of a fixed location. then they can leave their communications equipment switched on and leave it unattended¹⁷, freeing them to concentrate on their primary mission. They can be secure in the knowledge that if a message should come for them, it will be ready

for them to look at and digest at their convenience, rather than having to assign someone to 'baby-sit' the phone.

Text message systems are not generally 'real time' systems (though you can have this if you have a Telex, which also offers full duplex links). This has the advantage that having received a question, there is not the pressure for an immediate answer that the phone produces. The addressee has plenty of time (off line) to make a considered and full reply rather answering in haste and repenting at leisure.

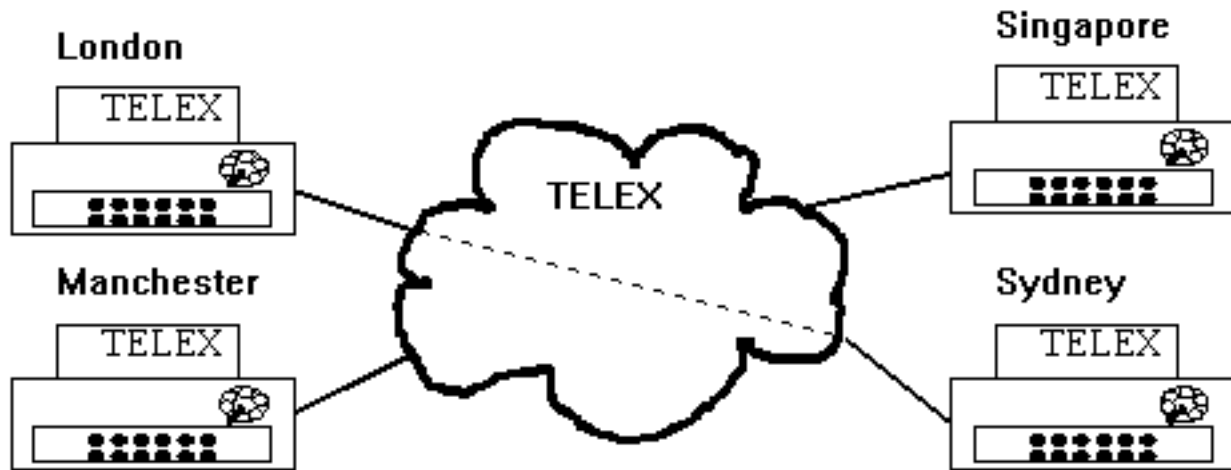


FIG 3 The international TELEXTELEX system is the text version of the PSTN. Any TELEX can 'dial' any other telex and leave a message even if the receiving machine is unattended.

It is MUCH cheaper in terms of call charges to send a text message. For example, by satellite the average short message cost USD 6-8 whereas the average short phone call will be USD 20-60. Text is the system supported by INMARSAT-C, which is the cheapest satellite system. A text message can be sent to any TELEX machine, Electronic Mailing system or computer with a MODEM, or text can be sent from a mobile unit in the field to a FAX machine on an ordinary PSTN landline back at the office, (called SEMI-FAX)

Language problems are very seriously difficult to overcome by phone with misunderstanding being the usual outcome. A text message may be handed to someone more competent for translation, giving the addressee more confidence in his understanding of the meaning.

1.2.4 AGAINST TEXT

The lack of human contact means that it is less reassuring than the phone. For those who are computer literate and used to keyboards, screens and commands etc. it is a natural way to communicate but for others it can seem rather daunting to learn.

Text messages need some kind of hardware to receive them back at the office, a TELEX machine, FAX machine or a MODEM attached to a computer or Electronic mailing system. There are obviously fewer TELEX or E-MAIL terminals than FAXes or Telephones at the time of writing, so this has to be taken into consideration when deciding who the addressee is.

While most types of communications gear are very tough, the Lap Top¹⁸ usually providing the terminals are not. Ask anyone who depends on Lap Tops and they will tell you what I mean. Computers also need regular charging, and a programme of backing up the hard disk to floppy disk. Remember that if your PC fails, nothing will work at all. The wisest thing is to carry at least two, both

loaded with identical software and compatible hardware. You will have to test out both computers with the communications gear as small glitches are easier to fix at base than in the field.

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Three times during the writing of this document the whole document was nearly lost due to computer problems; this despite using only licensed software. In one case a virus prevented the operating system on the PC from booting up and the hard disk had to be reformatted. The document was saved because of a regime of back up to floppy disc. BEWARE, computers can just CRASH (refuse to work) and it is the job of an expert to fix them when this happens. In the field, where there is seldom a Local Area Network (LAN), exchange of discs is frequent. Check each disc for virus before running it. Sometimes exchange of files is impossible because of incompatible formats. As far as you can, prepare files in the plain text ASCII format, or convert them to plain text (*.TXT) before exchanging them. Other formats look prettier and more professional, but plain text is the format least likely to cause problems. (Sending unreadable or corrupt files won't make you look more 'professional').

Any FAX machine back at the office can be used to receive a text message automatically (by Semi-Fax), but to send a text message from the office to a field team with a text terminal by fax, the message has to be faxed to BT MARINE's Portishead Radio station and then TELEXed from there. Alternatively faxed to a bureau or friendly Telex operator. There are plans to automate the sending of text only faxes in future. Text messages can not support graphical information such as maps, photos, diagrams etc.

A less obvious problem is that the field team will need to carry a printer. This is needed in order to print out the message on paper so that it can be passed to the addressee, if he is not able to come to the computer screen. Printers will need interface cables and Printer Driver programmes, some kind of power supply system, and plenty of the special paper and ink cartridges that the model needs, all adding to cost, bulk and weight. Take care to purchase only a model recommended for portable operation as many models, especially laser printers, will fail if moved roughly.

This fact also limits the usefulness of large data volumes, such as detailed maps and diagrams, in the field. A small portable printer can not do much with such documents. To printout anything worthwhile may need very large, heavy and expensive mains driven colour printers.

1.2.5 FOR FAX

FAX is not a separate system of its own like TELEX , but uses ordinary PSTN Phone lines. The FAX machine (Facsimile or Telecopier) scans the picture and sends it as data by a built in MODEM, taking usually less than 1 min per page depending on how much detail there is on the paper.

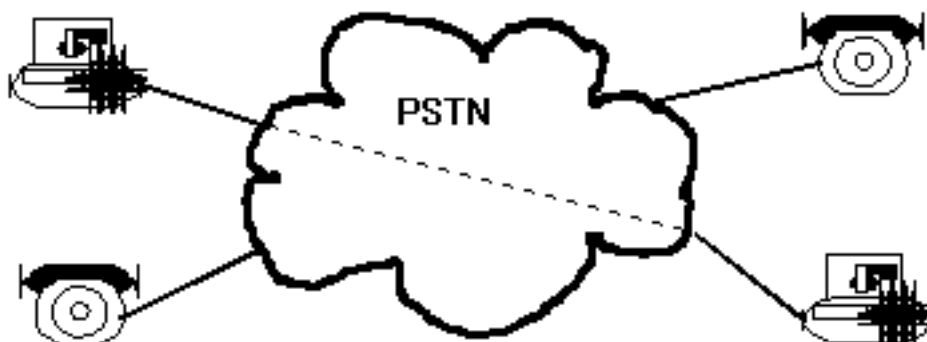


FIG 4 FAXes use the ordinary PSTN network.

It is the only system capable of sending graphical information such as pictures, maps, diagrams etc., and the only one sending handwriting in script. An important attraction is its ability to send messages in, for example, Chinese or Arabic text.

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The CICR (International Red Cross) prefers text messaging as a rule, but has found one advantage of FAX. Sometimes a convoy needs to pass a checkpoint or border and the local official is reluctant to allow this without the properly accredited certificate or form. By using fax a copy of the form complete with the stamps, seals and signatures may be shown to the official and this may sway him.

There are now a large number of FAX machines in existence, most small companies have them as do many people working from home. Many FAX machines also automatically stamp the FAX with the originating FAX number and date/time. A journal also keeps account of how many messages are sent or received from the FAX.

From the point of view of convenience, as operators are not required to receive faxes, all the same advantages apply as for text. The field team can leave it switched on, unattended and check for messages periodically.

FAX can be supported by INMARSAT-A, INMARSAT-B, and now INMARSAT-M though a special port has to be provided in the terminal for this. HF radio does not offer a public two way FAX system via PSTN at the moment, though there are projects working on this.

As an added bonus, most FAX machines offer a facility called Local Copy, meaning that it can also be used as a photocopier and some models can also function as a computer printer and image scanner.

If you do not wish to carry a Fax machine, any PC can be programmed to generate and receive FAXes. However this usually means that you can't use it for something else while it is waiting for an incoming call. The problem is that you would still need a printer to hard copy the FAX, to show it to someone who cannot come to the computer.

1.2.6 AGAINST FAX

You will need to carry a FAX machine around with you, and plenty of the special paper that some models need, as ordinary paper won't do for some models, and the correct paper can be hard to find out in the field (it even varies from model to model). You must take care to buy a portable model as some plain paper FAXes are sensitive to bumps and will just turn out grey rubbish once moved. The machine must be sited somewhere well-lit, dry and not windy (or incoming paper sheets blow away before being read).

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The Camel Trophy communications team reports that in very hot and humid conditions the fax paper tends to become sticky and won't pass through the machine. The solution is to pass two sheets through at once.-Transat.

Technical people tend to be less enthusiastic about FAX than, for example, electronic mail, because FAX is not very efficient in its use of bandwidth or data. For example it can be very slow over a Standard-M terminal. A big problem is, when you have received a FAX, there is nothing you can do with it but read it and store it as paper. You are not well advised to pass it on to someone else by FAX

as FAXes become unreadable after only about 4 re-generations. It is better to ask the sender to send a copy of the original to the intended recipient. Even if you scan the FAX into a computer, it can't read the message, which it treats like graphics.¹⁹ This means it can't be inputted into a word processor unless the whole thing is re-typed. Another problem is power, FAX machines need mains power, or regular charging if they have batteries.

1.2.7 SEMI-FAX

This is an automatic service provided by BT. It takes TEXT messages from its INMARSAT-C terminals, or from HF Radio Telex terminals,(which are in TELEX format), automatically converts them into a FAX image and sends the FAX to the number you specify. The problem is that it can send only text, no pictures and only works one way (from mobile to FAX machine).²⁰

1.2.8 ISDN

This stands for Integrated Services Digital Network.(ISDN)²¹ It is one part of this new Data super highway that everyone is talking about. President Clinton of the USA thought it so important that he assigned his vice president, Alan Gore to supervise its implementation. It will bring remote control libraries, video phones, and more besides in the future.

A big problem is that in field conditions you may not have the hardware to process the information. Also there may not be the time for anyone to generate or really digest the information.

ISDN is of use mainly to industrial / scientific and journalistic users at the moment and is supported only by INMARSAT-A, INMARSAT-B and INMARSAT-M . I have not included it for further consideration at this time. However if a need should arise for ISDN in a disaster or aid role, as it surely will in the future, the technology is there and I will be watching with great interest.

1.2.9 Internet Electronic Mail

'The Internet' is a network of computers connected together, mostly by ISDN circuits. I could write a fat book about this, but to simplify, it is a sort of super TELEX. There are however, some important differences to mention. You would use your personal computer to contact a 'Host', (an ordinary computer which is running a special mailing software and is connected to the Internet), either by Local Area Network (LAN) wiring in your building, or over a dial up PSTN phone line via a modem. You would then send you message to the host. The start of the message must be the Internet address of the addressee. This is not a number, as in TELEX but something like 'eus.eusmwoo@memo.ericsson.se', which is my address. (You are welcome to contact me this way if you wish). When you have finished your message, it is passed from host to host until it reaches the host which is the mailbox for the addressee.

It then remains there until the addressee next connects his computer to his host, when the message is then read on his computer screen, or printed out. The problem is that there is not always a bell or bleeper to alert the user to log on (connect up) and retrieve his mail, so he may be unaware if there is an urgent message pending. Although the message takes a few seconds to go to the mailbox, it could be hours or even days before the user logs in next, so it is best to alert the user in some other way if you have sent an urgent E-Mail message via Internet.

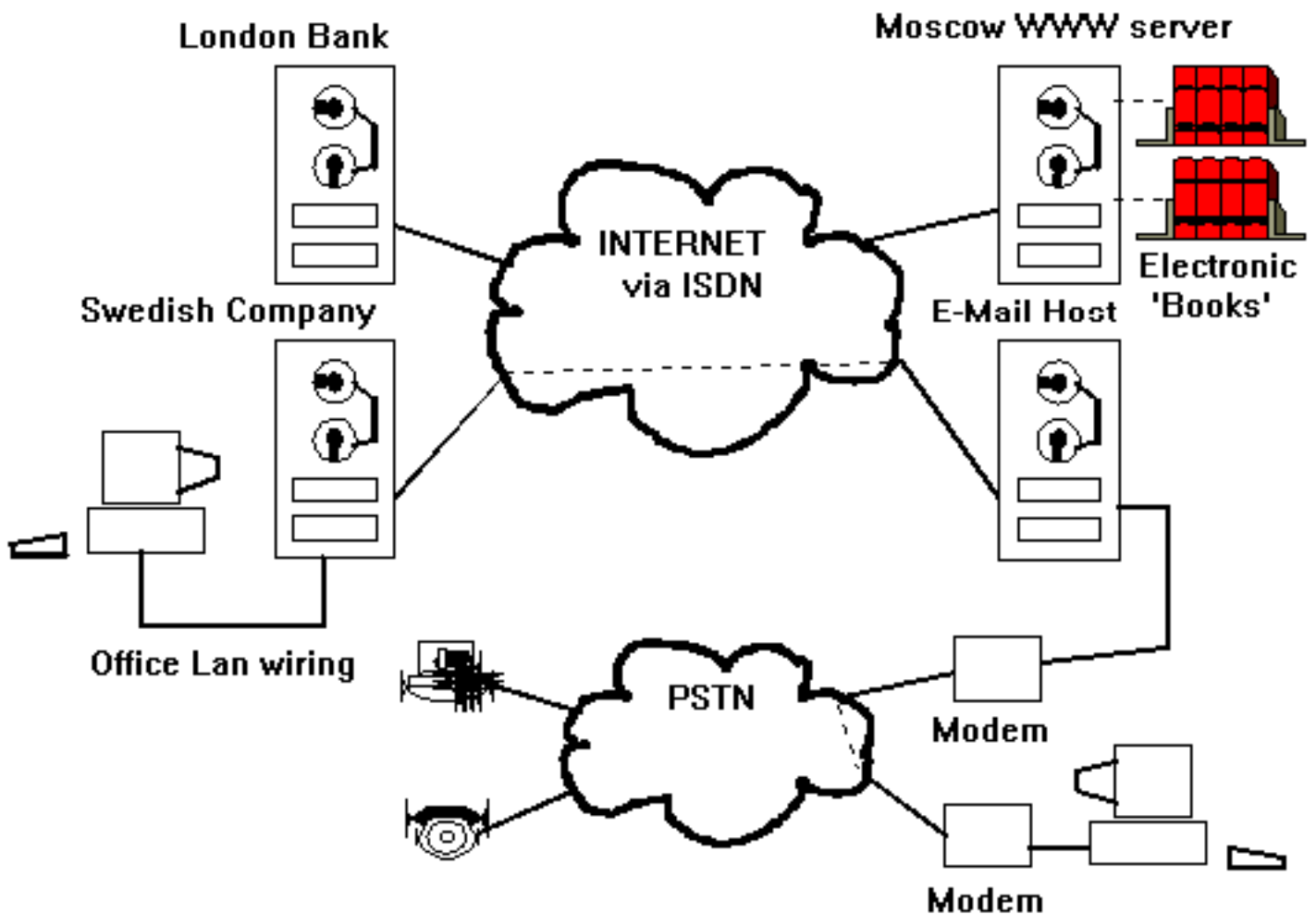


Fig 5 ISDN is like a 'phone system' for computers enabling them contact each other. This is how services like Internet and World Wide Web are supported.

1.2.10 World Wide Web (WWW)

Another use for Internet is to download computer data files from disc drives in machines far away from your own, by so called 'File Transfer Protocol' (FTP). There are many ways of doing this but I will not elaborate on them here because they are not strictly communications related functions. The World Wide Web (WWW) uses a special form of Internet signaling, called Hyper Text Transfer Protocol (HTTP), designed for remotely reading 'Electronic Books'. Special 'WWW Servers' have electronic books, including pictures and diagrams, available for browsing at the click of a mouse.

This book, and others by the DRCF will be readable on the web. disaster users could read maps and information about the area where they are working, for example. The WWW system is still quite new (in 1996) so the information is quite patchy at the moment. My prediction is that once money starts to be made on it, it will balloon to stupendous size and become one more of those thing we can't live without.

When you are browsing through WWW in your office, over your LAN that is one thing, but trying this over a satellite link or HF radio link is quite another. WWW files often contain detailed colour pictures or graphics such as logos at the top of each page. These use much, much more data than the whole of the rest of the document! Wether you pay by the kilobyte or by the minute, you pay very dearly for every byte you download to the field. You must resist the temptation to browse aimlessly with WWW in the field. The solution is to let someone at HQ browse for the information for you, then

edit and send a digested version to the field. Or you can programme your client application (Mosaic or Netscape) not to download images unless you say so. Don't be tempted to download something that 'looks interesting' unless you are sure that someone will have the time to digest the information.

The best book on this is 'Internet for Dummies', see Bibliography.

1.3 Networks

An important subject that you ignore at your peril is Networks. Both HF radios and Satellite terminals can 'plug in' to the international phone system, but the problems don't end there.

The chances are that the people you need to speak to are on the move themselves, like you are. Do you know what phone number they can be reached on? Are they using radio, or satellite terminal, phone or Telex? Who is their assistant and who is their manager?

Who has the equipment you need, where is it, when can you expect to have it? Who needs the equipment that you seem to have and can't find a use for? Why are you twiddling your thumbs when you know you are desperately needed elsewhere? Do your sponsors know where you are or are they desperately trying to contact you?

To compound the problem greatly, virtually none of the established systems allow communications while on the move in a car. Most types of gear have to be unpacked and set up before use.²² Because of power budgeting, things can't be left on indefinitely when not in use and security aspects go against leaving things unattended. Anyway, there is no point in setting up your very expensive satellite phone if you can't be in ear shot of the bell!²³

In fact, communications gear may be only switched on for a few hours a day, once or twice a day or when convenient. Do you know when the station you want to talk to is 'on watch'?

To save money, HF radio can be used directly from point to point in the Simplex mode. Do you know what frequencies and at what time your colleagues monitor? There are usually daily 'round table' 'chat shows' where local teams can chat about the problems of the day and help each other. Do you know when and at what frequency they occur?

If you tried to address all these problems when out in the field, you could waste hours of each day and a lot of money on the necessary calls. Obviously someone back at base, usually called a traffic dispatcher needs to track all of this information and funnel it back to you. That person should be the sort of person who is not shy of making a nuisance of himself, being a real nosey parker, minding everyone else's business and hoarding every scrap of information and gossip he hears.

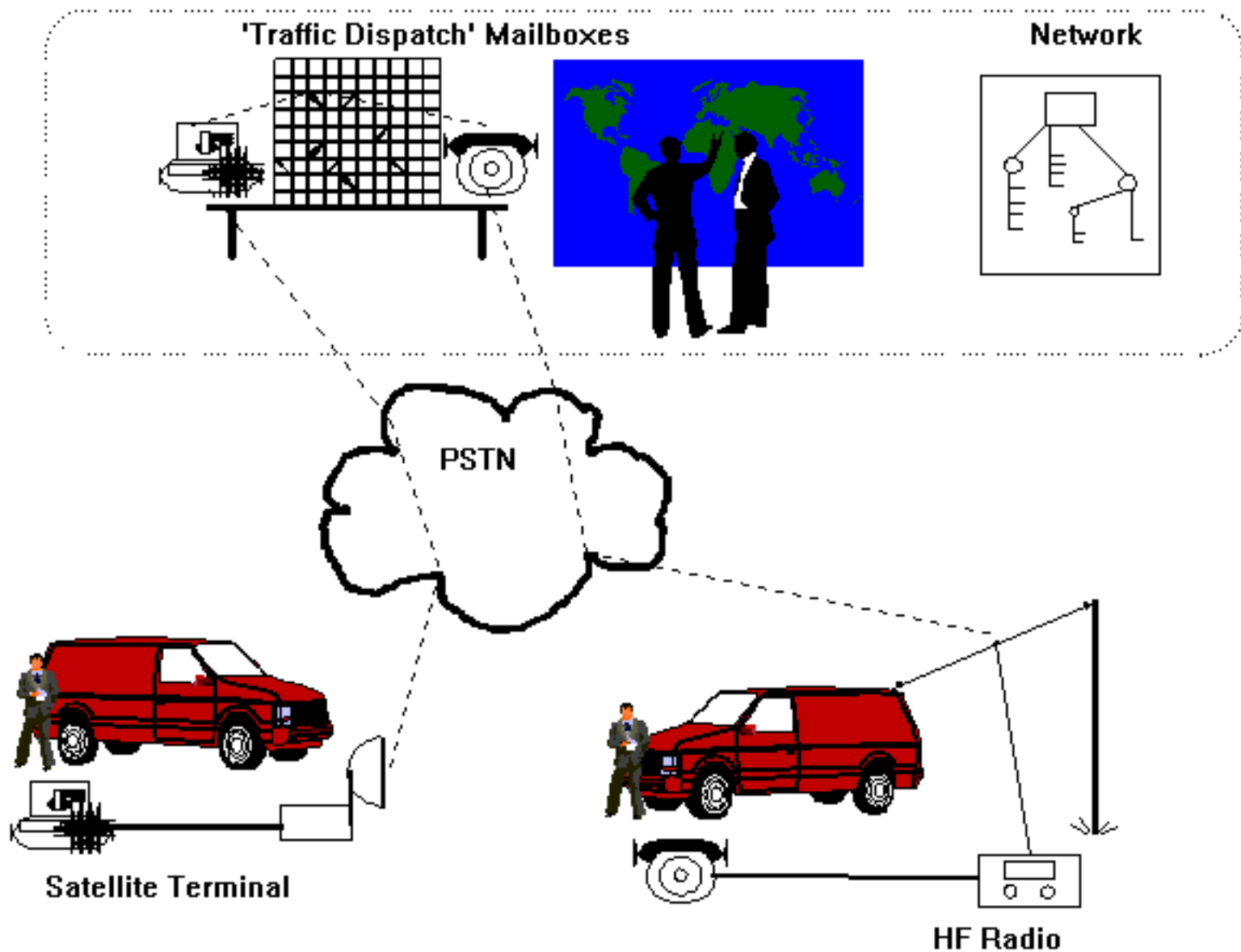


FIG 6 Having a Traffic Dispatch function maximises the value of any system.

=Report=Report=

This is the method favoured by the BBC and most News organisations. Journalists call in to a phone number called 'Traffic'. First they are passed any messages for them from elsewhere in the BBC, which have been sent to the traffic dispatcher. They then dictate their report over the line which is either tape recorded for transmission or typed out. This is what has happened when you see a Photo of the journalist and hear a scratchy voice on the TV news.

Everyone must report their position and status, and agree to (and keep) scheduled reporting times (called 'Skeds'), this includes you. You should also report who is with you and from what organisation they work so that messages to them can be expedited. Another advantage of such an approach is that if you go out without an exhaustive phone directory, you have only one number to remember to retrieve the rest. Your coast radio station can help you to find who you need if you are really stuck, provided they have been warned in advance.

1.3.1 Trafficking messages

One reason for the reluctance of some people to send particularly important messages by text is lack of confidence in the system. When you make a phone call, you can hear a voice you know saying "Yes, I see" or "got all that, I'll have it done by your next sked". If you send a text message, he will

have a much better idea of what you really want and won't forget the important details, that is, **if** he gets the message. You may need to know **when** he got the message for logistical reasons.

Do you remember the old fashioned Telegram with a sigh of nostalgia? Well there is no reason to dismiss it as a relic from the past. Over a hundred years of experience has made trafficking telegrams a thoroughly mature art, and there are many features of them that we do well to learn from. You may scoff now at the unreadable gobbledygook in the first line of a telegram, but this was the 'Preamble' and its function is very important.

The first thing it tells is a unique message number and where it came from. From then on and forever this message will be identifiable amongst all the others. this will make it possible to refer to this message later and in this way track its progress. The number may be something like 'Aidcamp4' meaning the fourth message aidcamp base sent that day.

Obviously we also need to add at least the date and time when the message was sent, to avoid confusion, this should be in GMT (UTC). The preamble must say unambiguously who or what department the message is going to (The addressee). Other information such as how urgent the message is, is optional but these are the minimum. Other options are to say how many words there were in the message so that we can have confidence that we got all of it. It is a very good idea to end the message with a + sign meaning 'end of message', or the word "more . . .", if there is more to come.

```
=AIDCAMP4 941005 1058
=TO BLOGGS AIDBASELONDON
=RECEIVED YOUR AIDBASELONDON 3,4 AND 7.
=DR SMITH AND NURSE JONES ARRIVED 0900 TODAY. WHERE IS THEIR
EQUIPMENT?
=BILLBROWN+
```

Fig7 a well formatted text message. need not be so formal as this but should contain information uniquely identifying it. Notice confirmation of arrival of his messages number 3, 4 and 7. He can now 'check them off' in his log.

```
=AIDCAMP5 941005 1400
=TO BLOGGS AIDBASELONDON
=SORRY JOE I LOST YOUR AIDBASELONDON 9 PLEASE RESEND IT.
=BILLBROWN+
```

Fig 8 A 'service message' is about messages. it is only possible to track lost messages properly if they can be identified.

1.3.2 Keeping a Log

Whenever a message is sent or received, a note about this should be kept in a special book, called a Log book.²⁴ There should be columns in the book for details about the message such as who sent it, when, and when it was passed on from our station to the next one in the chain.²⁵ Another important feature should be a confirmation of when the message was received by the addressee. This will help us to know how long it really takes to send a message to someone, for future reference. Even the destination and duration of phone calls must be so entered so that charging can be tracked. Someone must check the log books at least each day to make sure that messages did get passed on and were not forgotten. This also applies to messages written on paper by hand and sent in person by truck. Check that they were acknowledged by the place to which they were sent for onward transmission, and that they were acknowledged by the addressee in due time. With some systems, this is automatic.²⁶

Message number	Handed in/sender	Addressee	Sent/received via	Acknowledged
Aidcamp 1	941005 0900 By Brown	Aidbaselondon Bloggs	Portishead by 1000	HFlex BJB
Aidcamp 2	941005 1000 Dr Smith	Aidbaselondon Bloggs	Portishead by 1000	HFlex BJB
Aidbaselondon	941005 1400 Bloggs	Aidcamp smith 1500	HFlex Inmar	1700 BJB
Aidcamp 3	091005 1600 Jones	Helpgroup 5	Synchronised with Dr Smith in turck	

FIG 9 A log book helps keep track of messages and makes sure none get lost.

1.3.3 Echo Tests

Periodically it may be useful to use Echo Tests. These are messages to the other stations below you on the network hierarchy. They should ask the person receiving the message to send a message saying at what time he **read** the message. This will give you a realistic idea how long it takes to send a message to someone. If you think it is taking too long, you can revise your procedures to speed things up. If you get no reply at all, you can suspect a technical fault and get it fixed before an emergency call is lost. On the other hand they do cost money and are only needed if there is not enough regular flow of traffic to a particular destination to promote confidence in the link.

1.3.4 Summary

Every solution brings its own problems, so someone in your organisation should set their mind to the networking problems that communications solutions will present. You don't have to have an elaborate control room set up, rather someone trained and resourced for this responsible task. If you don't, you will be wasting a lot of your money on expensive technology that is not being used efficiently.

At least two British organisations²⁷ are now looking into the problem, with the aim of establishing a central 'clearing house' (not central control) for such information which would be manned round the clock with communications experts.

The United Nations Department of Humanitarian Affairs also has such a scheme called the On site Operations Co-ordination centre (OSOCC), a field communications centre with expert operators in the field at the site of the disaster. They are equipped with Satellite, HF and VHF equipment and link to a control room in Geneva. Information about how to work with them is available from the UNDHA telecommunications centre at the Palais des Nations in Geneva.

Only when we have thought out these basic factors about our communications needs, can we now

approach the systems technologies that will act as carrier to our communications. However it may also be that we need to modify our organisation's culture to accommodate what is possible within the budget that we have set ourselves. Anything is possible with technology but at a price. Only when we have considered both things can we engage in intelligent discussion about this, so lets start looking at what is on offer.

¹Americans call it the 'Plain Old Telephone System' (POTS), 'Ma Bell' or 'the twisted pair'.

²In this document the PSTN will also mean the Public Land Mobile Network (PLMN), also known as Cellular Mobile Telephones. The PLMN depends on transmission from the bearer network and terrestrial Base Stations within 50Km of the disaster zone. Therefore it may be nearly as vulnerable to disaster as the PSTN is.

³In fact the different services are usually switched by separate systems but sent down the same line transmission network (for reasons of economy). This is known as the Bearer Network. It uses the local telephone exchanges in the area. If it fails you will lose everything depending on it.

⁴This is also true of Telex and ISDN services which depend on the bearer network.

⁵It is intended to update the document annually, please contact DRCF for an update.

⁶Disaster volunteers are usually professional or qualified people who agree to make themselves available on a callout basis. They are either sponsored by their company or take annual leave during the call. This is the reason for the short availability window of such teams.

⁷In this book men shall also mean women.

⁸Because volunteers are seconded from their full time professions at short notice, a term of duty for one person will normally be 10-15 working days. After this, new persons will probably be needed to continue the operation if required.

⁹Qualified Radio Officers are well suited to Disaster Communications duties.

¹⁰A Radio Officer is a highly trained (to 3 year HND level) professional person who is not only technically trained but also trained in normal and Emergency message handling. They must hold an international permit to operate such as a Marine Radio General Certificate. They typically have a background from ships, expeditions or the military.

¹¹A Radio Operator is trained only in operation of the equipment and normal message handling. Training typically last a few days.

¹²When both ends at once can talk, it is called 'Full Duplex'. If they have to take it in turns and say 'over', It is called 'Simplex'.

¹³In this document, He or Him shall mean She or Her.

¹⁴You can tell your coast radio station to interrupt you when a certain time or a certain charge is up.

¹⁵In text messages, the sender is the person whom message is from, the addressee is the person to whom the message is sent. This distinction is made because a message arriving at one telex may be

sent on to another to reach the person or persons who are the addressee(s).

¹⁶In this document the term Personal Computer will mean in the generic sense.

¹⁷Provided there is reliable power and security.

¹⁸In this document 'Lap top' is used in its generic sense.

¹⁹There are 'text bridge' programs which recognise text and will re-generate the text as an ASCII file, but they are laborious and unreliable.

²⁰Very often used by the UN and others.

²¹In this document ISDN will include Public Packet Switched Data Network X25.(PPSDN) and Public Circuit Switched Data Network (PCSDN) and TCP/IP INTERNET networks. Although separate logical networks, they all share the same vulnerability to the bearer network.

²²Only INMARSAT-C and HF radio (in good conditions) can be used in a moving vehicle.

²³Cordless phones can be directly connected to some models of INMARSAT terminal

²⁴This is a legal requirement in most countries.

²⁵There may be good reasons for passing messages to another place with better contacts for greater economy or reliability. If so you must check that they did remember to pass the message on.

²⁶Many systems carry out this operation automatically, but confirmation is sometimes only provided when you remember to request it. As it costs about 16P per message it is well worth it. It is still worth keeping a paper log book separately in any case.

²⁷The Path-finders, of the 'World Memorial Fund for Disaster Relief' and The Cranfield Trust.

CHAPTER 2

2 SATELLITE SYSTEMS

This means networks intended for users on the Earth but which have some equipment in space, i.e. a satellite. Different satellites do different jobs, such as taking weather pictures or finding accurate positions. Communications satellites are usually quite different and are sometimes referred to as COMSATS, though this is actually the name of a major satellite consortium. Other words you may hear are the word for satellite communications in general, SATCOMS, and the word for a satellite phone terminal, SATPHONE.

Comsats in turn come in two different types

- **GEO** (Geostationary), such as the COMSAT and INMARSAT systems. And the regional 'spot beam' systems such as AMSC.
- **LEO** (Low Earth Orbiting) such as Iridium, ICO, Globalstar, Odyssey, Constellation, teledesic, Ellipso, Oscar and Satellife.

Low Earth Orbiting (LEO) are of the same class that will be used for future systems intended to bring Global hand-held phones that fit into the back pocket and work just like a 'portable' 'mobile phone'. Though scheduled for availability in 1998, they may not be working until the first decade of the next century.²⁸

There is also a Packet data system by LEO satellite, with the satellite acting as a world roaming mailman beaming messages up and down as it passes. The system is very cheap to run and was invented for the benefit of aid agencies with low budgets. There is information about this in the appendix,(see SatelLife and VITA). We will come back to LEO systems later, but for now let's get on with Geostationary systems.

2.1 THE INMARSAT SYSTEM

The most practical and the only global satellite system for use by disaster Relief field units at the time of writing (1996) is the International Mobile Satellite Organisation's system (INMARSAT). This system was set up as long ago as 1976 and was at first intended for use by, for example, large cargo ships. This explains why many seafaring terms such as the " Ship Earth Station" (SES) and "Coast Earth Station" (CES) are used in the INMARSAT system.

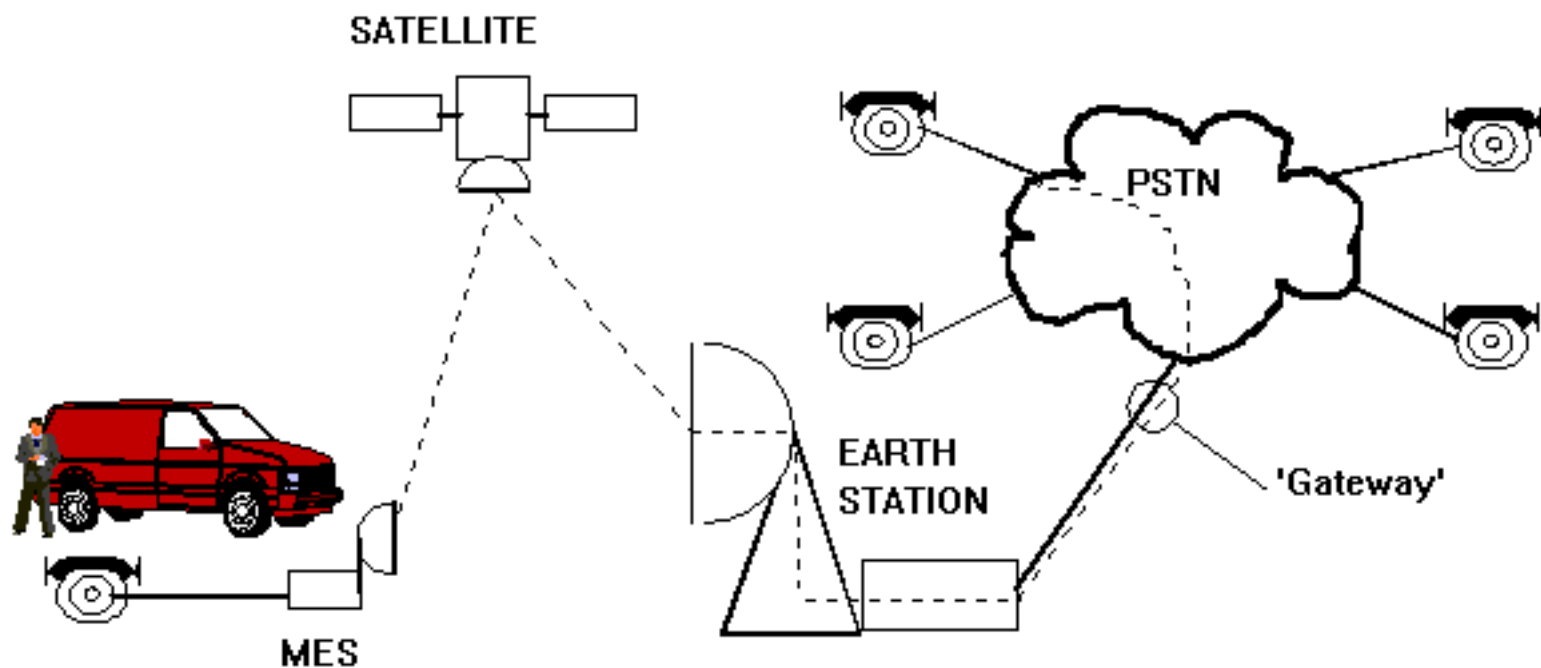


Fig 10 The INMARSAT system connects you to the PSTN, TELEX or ISDN

Since then however, many more land based users have started to use the system, so the terms Land Earth Station (LES) can be used instead of CES and Mobile Earth Station (MES) instead of SES. Do not be confused if you see these words, they are exactly the same thing as before, but by another name. The only difference is that SESs tend to be physically larger and are intended for permanent installation on board a ship. The other difference is that ships tend to wallow about while the call is in progress, so the antenna dish (protected by a egg shaped radome) needs to have a complex and expensive tracking system to keep it pointing at the satellite as the ship rolls and pitches around, and as it changes course.

Most new MES's tend to be fitted inside briefcases and have disassembled antennas. this is why they are much cheaper and smaller, though their function is the same. It is taken for granted that an MES user will not move the dish once it has been assembled, therefore a tracking system is not required. Most also have removable antennas, which gives highly desirable flexibility. You can put the antenna outside, and make your call inside in the dry and warm.

The INMARSAT system utilizes four geostationary satellites and about 80 land earth stations dotted around the world and operated by various Telecomms companies. The British CES is 'Goonhilly' and is operated by BT. The MES (our kit in the field) links up to the satellite, then down to the LES and then into the normal Phone, data, fax or TELEX system.

One awkward thing is that someone calling the MES has to dial a code for the correct satellite first, so the MES operators need to let everyone know which one his dish is pointing at. This is important because in many places in the world, such as Africa, two satellites are in view and either could be used. The choice will depend on where most of the calls from the MES are intended. The MES operator will consult his operating manual for this information, then inform all potential callers of the dialling code change to reach him. However there are some LES stations which try both just in case, ask your LES if in doubt. Another drawback is that the system won't work at all above about 70 degrees north or south. However since this is above the arctic and antarctic circles, you are unlikely to be working there without expert guidance and special equipment.

* NOTE

By far the biggest problems are not technical, but political. Some countries ban the use of **any** land mobile satellite equipment on their territory, or take up to 7 weeks to grant a licence, charging up to hundreds of USD per year for a licence for one terminal. That is a worst case scenario, usually it is much better than that, and the rules vary from country to country and day to day. The good news is that they **may** make an exception for Emergency relief and disaster mitigation units, in which case a fast track method must be employed. (See Licensing Chapter 5.) There is more information in the appendix.

There are 4 completely different System Technologies for INMARSAT at the moment, (though INMARSAT are working on another more advanced LEO version also, under the name ICO, (formally INMARSAT-P), to be introduced around the year 1998). The existing system technologies in 1996 are:-

- INMARSAT-A (Standard-A)
- INMARSAT-B (Standard-B)
- INMARSAT-C (Standard-C)
- INMARSAT-M (Standard-M)

2.1.1 FOR INMARSAT-A

This one has all the 'bells and whistles'. It can handle telephone calls, by direct dial in and out, and the calls are always of very good quality. The lines are so clear that the channels can also be used to send Data via a modem or if you have the high speed data option, (so it can support Electronic Mailing), or FAX. Built in circuits in the MES makes the terminal output look just like a phone line, so anything that can connect to a phone line will just plug straight into the INMARSAT-A with no modifications needed.

It can also connect into a switchboard and be available to many users via a field telephone system. INMARSAT-A supports Full Duplex TELEX (this means a two way conversation could be held by TELEX).²⁹ It is reliable and easy to use. The latest equipment also enables the sending of full motion video (though not in real time) and good quality colour stills, with the installed 56/64 Kb/s high speed data option via ISDN. As a security precaution against unauthorised use, most terminals offer systems such as separate passwords required for each authorised user, with separate logging for each one.

2.1.2 AGAINST INMARSAT-A

The older equipment is quite big and heavy, being the size of one or sometimes two large suitcases and weighing about 30kg. Newer models weigh about 18kg, not including auxiliaries and generator.

It needs mains power (or a generator or inverter which are also big and heavy) and it can't be used on the move.

It is also the most expensive system. A typical unit may cost about 20,000 US Dollars or more for the High speed data options and calls cost about USD 6-8 per minute peak, USD 4-5 off peak. (see appendix for details)

Most manufacturers have discontinued development on standard-A now, so it is likely to be left behind in the technology race in the future, though they will continue to support the existing models for many years hence.³⁰

2.1.3 INMARSAT-B

This is the digital replacement for INMARSAT-A. It can do all the things that INMARSAT-A does, Phone, Data, FAX, TELEX, but at much lower call charges. This is achieved by more efficient use of the satellite and power. It can also provide high speed data links by ISDN services, but as these are more interesting to broadcasters and industrial users, because of their having higher budgets, I will not talk about them much more. However I am watching with great interest.

2.1.4 FOR INMARSAT-C

Standard C is a Store-And-Forward TEXT messaging system capable of connection to TELEX or data networks or sending text only messages from a mobile to a FAX machine. It has all the advantages of TEXT communications as already discussed. It is also much smaller and lighter than any other system being about shoe box sized and weighing about 5-10KG.

There are many different manufacturers in this field and INMARSAT-C related products continue to be developed and will continue to be improved upon for the foreseeable future. The system is very reliable and much loved by professionals everywhere. For example it is used by the UNDHA, MSF, Red Cross and dozens of others.

Unlike most other system satellite systems (except standard-M), it **can also be used on the move**, such as if fitted to a Land Rover, if non-directional antennas are used. There are also many models looking like a briefcase with the antenna built in to the lid.³¹

Text messages can be prepared off line by a Personal Lap Top Computer with all the huge advantages that users of PC will be familiar with as regards word processing. Power requirements can typically be met by batteries such as vehicle batteries. The equipment is usually very tough and highly reliable.

The latest application is for a remote version of CC:mail, a popular electronic mailing system. By use of the system, a person with an electronic mail account can continue to communicate from his account even from a remote location.

It is the cheapest satellite system costing around USD 5,000 per unit and calls costing about USD 2-3 per average message. Automatic Notification of delivery of message costs about 20c. Importantly, it uses little power and can run off batteries for days.

2.1.5 AGAINST INMARSAT-C

This is a text-only system and cannot send voice or graphical FAXes such as maps to or from a normal FAX machine. However script in Arabic and Chinese and the Cyrillic alphabet can be supported by special software, provided that the equipment is available at both ends of the link. TELEXES can only be in the reduced character set supported by those machines.

It is a little harder to learn to use, and doubly so for any person not computer literate as a laptop PC is usually the terminal. Those familiar with word processors will find it similar to use, only you press transmit instead of print when you are ready to send.

The whole system is only as reliable as your 'lap top' or terminal. The Standard-C gear is very tough but less so the drives in the laptop, you must purchase only the most trusted model or the system will not work, anyone who travels with 'lap tops' regularly will know what I mean. Good training and thorough preparation is a 'must'.

The same applies to power, you must keep the batteries charged in your PC, and budget your power wisely. Only experience will teach you the tricks you will need before you feel confident with your Lap Top PC. You must avoid the temptation to play games on your lap top in the boring evenings.

When in TELEX mode it does not sport full duplex 'chat back and forth' operation but can only send a message and then wait for a reply. This is called the 'Store and Forward' method.

2.1.6 FOR INMARSAT-M

INMARSAT-M is a direct dial in and out phone service via PSTN. Its designers wanted it to be the nearest thing to a mobile phone possible with geo stationary satellites, so its very easy to use and easy to teach. The cost of calls on standard-M is about half that of standard-A, at around USD 5.00 per minute or lower. The MES terminals are fairly compact by comparison with INMARSAT-A, or -B, being about briefcase sized and weighing about 10kg as opposed to the suitcase size and 20kg for standard-A.

Some later versions will be able to work from a moving vehicle. It is also able to send and receive FAX by the use of optional special circuits built in, a special separate socket and a separate phone number is then allocated to the fax socket on the terminal. By the middle of 95, it is expected to support DATA at the rate of 2.4Kb/s.

Some INMARSAT-M terminals can also be powered by their own internal batteries for 8hrs on standby and 1hr talk time. Being a new service many manufactures are still making them better and better yet, so we can expect quite exciting things from standard-M until it is superseded by the future LEO systems after the turn of the century. There has now been a few years experience with the system at time of writing, UNHCR and Red Cross are examples of organisations using the equipment and are reported to be very pleased with its reliability, some 7,500 were in use in by 1995.

2.1.7 AGAINST INMARSAT-M

The only thing against is the initial cost of the equipment, which will sell for around USD 15,000 plus tax. It is still subject to the same political problems as all other satellite systems, namely that the equipment may be banned or a very large customs duty be required. However the situation is better than for INMARSAT-A because of the lower emitted power from the unit. However it is rather slow in FAX mode, taking four times longer than standard A to send the same page and therefore costing twice as much.

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One big problem for operators using this equipment is that it is the victim of its own success. It is so easy to use and gives such clear lines that a user can be seduced into dropping into a relaxed telephone style and taking 10 mins to say something that could be said in 3. When you get your first bill from one of these you could wish that you hired a team of Trappist monks. Three weeks of using one standard-A terminal in Zaire for the Rwandan operation cost the UNDHA CHF 29,800. Data or FAX modes are much more cost efficient than voice so they must be encouraged. As in all things, training and discipline pay off in the long run.

2.1.8 Data over Inmarsat

With the advent of Electronic Mailing, Internet and the World Wide Web, there is more and more interest in data over the Inmarsat system. Standard-A can support ordinary modems without modification but only certain models seem to work well, you must ask someone experienced before you choose your model. The others systems also offer data services but there are special complications that you must know about. My research on this topic is ongoing at the time of writing and so I have given a summary in the Appendix about my findings so far. At the moment you need good advice and support for serious use.

2.2 FLEET MANAGEMENT SYSTEMS

This is a rather exciting system whereby a trucking company manager, for example, can have an electronic map of the world in his personal computer, showing the position of all of his trucks and giving information about their status e.g. what they are loaded with. A further facility is that the manager is able to type a message into his computer, and have that message go immediately to one or all of his fleet.

However this is not a separate new network as such but is a clever combination of GPS (Global Positioning System) to give the truck's position and INMARSAT-C to transmit the position and other data about the load to the management centre and to dispatch orders to the driver from the management centre, the data being processed separately by software running in the company's own P.Cs.

It seems that the Air Traffic control Authorities are interested in this technology to supplement radar surveillance. The air version will be known as Automatic Dependent Surveillance (ADS). Traffic controllers are very, very cautious people, so if they are considering it, then this is a measure of it's state of maturity.

2.3 Regional satellite systems

Regional systems are usually implemented by only one satellite rather than several. Furthermore, the antennae on the satellite beam the energy into one area on the ground, known as the 'footprint' or 'zone'. Regional systems don't offer global coverage but rather only in the area inside the footprint. Each footprint can be very large, encompassing a whole country or economic group, for example. In the American Mobile Satellite Corporation version, one zone covers the whole of the East coast two further zones cover the midwest, while another the West coast of the USA. In that system, several zones are connected together to offer system coverage of the whole of North and Central America.

The charges for regional service are usually very much lower than for global systems, by half as much. So as long as you are sure that you will be working in the covered area, a Regional system may prove to be the most economical. It is thought that many new systems will emerge, so it is worth while checking the situation in your region frequently.

2.4 The LEO systems

Very few people doubt that the LEOs are by far the most important development in disaster Telecommunications in the near future. The very successful introduction of the 'mobile phone' systems all over the world have stimulated a demand for personal communications which is as

unquenchable as it is profitable for the operators of these systems.

Normal mobile phone systems have the problem that they are provided by ground based 'Base Stations'. These need to be carrying at least 8 calls at a time in order to be economical, yet their range is limited to about 35km, so they are usually only provided in urban areas. Satellite systems have the disadvantage that they need bulky and usually fixed antenna systems to make them work, so this makes them hardly 'handy' and certainly not 'portable'.

The solution is to bring the satellites much lower to the ground (300 km) and so able to be contacted with a more convenient antenna suitable for mounting on a hand held 'phone'. The problem is that 1) you need far more satellites to do this as each can now 'see' a smaller area. 2) they move much faster across the sky and so loose contact with the user after a few minutes, thus requiring 'handover' systems not unlike those used in mobile phone systems.

The different operators who have so far declared themselves (Iridium, ICO, Globalstar and Odyssey) each have different systems technologies for solving these problems, and need anything from 12 to 84 satellites to achieve global coverage. At the moment I don't know which of them will be the most successful and the technical differences are mostly of interest only to techno-buffs.

One thing I do know is that if they work as well as promised, and cost as little to operate as promised, then they could make everything else obsolete overnight! It is an open secret that the big Mobile phone makers, Motorola, Nokia and Ericsson are all spending a lot of money on developing 'dual standard' phones designed to work on the new LEO systems. The idea is that the phone will act as a normal mobile phone in an area where the system is provided. However it will automatically switch to the satellite system if either you have strayed out of the area where the system is provided, or if the normal system is out of order, for example because it has been destroyed by a disaster.

To add to the attraction of this very convenient personal communicator, all of the operators promise high speed data applications for their systems. There will also be built in position finding in the phones so that you won't need to carry a separate GPS receiver. You will have Phone, message pager, Data terminal and GPS in one hand held unit, all of which could be immune to damage from a disaster no matter of what scale.

The problems facing the new systems are that each is a very ambitious new technology, so progress with bringing their products to market may not be as rapid as they are forecast now. Each has pledged to start launching in 1998, which would put a strain on the world space launcher industry even assuming no hitches at all.

Coverage may also be a problem in that signals may be too marginal to work inside buildings at all. It may be that you would have to be outside, with a clear view of the sky, to make a call. There could be severe hitches with data transmission at first as the air interface will be much more variable.

By far the biggest problem may be political. A government may see the system circling overhead as piracy or even technological imperialism. Persons could make calls from a countries sovereign territory without needing any government provided facilities, without asking and without paying a penny to the national purse. There are enormous diplomatic and political problems for the operators of the LEO systems to resolve. Probably for quite a while, there may be countries where use of these phones is prohibited or very large licence fees may apply. In fact a situation exactly the same as applies to the INMARSAT system now.

These are the promises and the problems, we will have to wait and see if it will be delivered. In any case a full service is unlikely to be working until around or after 2000-2010.

2.5 Satellite Dispatcher systems

It seems that most of the space operators are concentrating on fax, data and conventional telephony applications for their terminals. However there are some limitations with conventional telephony which we need to be aware of.

By phone, you can only talk to one person at a time. In the case of a large scale disaster, you may need to share information and ideas with as many as 10 persons at a time. If you had a three minute message to send to 10 persons, this will take you half an hour, presuming no hitches at all. This will cost you USD150 on call charges and use up a lot of your time that you need to spend on more important things. Even a conference call is not the answer as you will not be able to talk to 10 mobiles at once, and in any case you will be charged air time for each mobile, the bill could still be huge!

This is why such authorities as fire brigades don't use mobile phones even though they could afford them. With open channel systems, when one station speaks, all the others hear also, so that information is passed around in real time. When a station is now called for comment, he will not need a briefing as he has been getting a rolling briefing the whole time. This means that important officers can be out in the field putting their experience to use instead of sitting in a briefing room reacting to old news and smiling at the media.

In the past this was done by VHF repeater networks which were sadly, very short range. Around 50 KM was normal. But now this type of service is available by satellite with a resulting much larger range.

It seems to me that if all NGO's shared the same global satellite system which offered both data/phone and also this dispatch service, then co-ordination would be much easier. Units could join and un-join groups as they need in order to work together better. Also in dispatcher systems, there is **no charge for air time** of the satellite, rather a fixed monthly charge for activation of this service. This would keep the costs under strict control while removing monetary barriers to the more extensive use of these systems.

This is my private view, but I acknowledge that many people I respect have different views.

²⁸*Estimates vary from 1998 to 2010.*

²⁹*However it is wise not to use the direct telex mode because it is very expensive to hold a conversation this way, with people thinking and then typing the answer. Better to send a message then go off line and wait for a response.*

³⁰*INMARSAT promises to support Standard-A until at least 2005.*

³¹*These days the term transportable means man carryable but not intended to be operated while carried in the hand.*

CHAPTER 3

3 HF RADIO (TERRESTRIAL SYSTEMS)

'Terrestrial' means 'of the ground' or 'of the earth' In this context it means any system having no part in the air or in space, as all the radios are on the ground and do not communicate with satellites in space.

Do **not** confuse Terrestrial with the so called "Landline" systems. Landline systems mean the normal 'phone' lines (PSTN), TELEX and Mobile Phones. As stated earlier we are assuming that the landline systems are not working because of the disaster, or that they have never been provided in the area we are working.

Terrestrial in this context will mean 'by **HF radio**'. In contrast to the 'technologically sexy' image of space systems, 'Steam Radio' can seem rather obsolete, but not so. It takes its own place in the market as we shall now see.

For an explanation of how HF radio works, see the tutorial in the **Appendix**.

The main networks of interest to us are:-

- HF Marine Radio
- HF Gateway services
- HF Amateur Radio.
- Private HF radio networks

3.1 INTRODUCTION

Radio waves travel in straight lines (except at very low frequencies) and the earth is curved, so we should not be able to communicate with anything we can't see. In the TITANIC era, ships used very low frequencies (500KHz) to take advantage of a bending effect called refraction, but even then the range was only about 1000 miles. (this is called the Ground Wave mode). Above about 3MHZ this effect is less pronounced, and so amateur scientists were given this apparently useless frequency range, which no-one wanted, to play with. This was the origin of Amateur radio or HAM radio.

Imagine their huge joy when they found that, quite unexpectedly, these shorter wavelengths could travel across the Atlantic Ocean, and in fact world wide. The phenomena was called Short Wave radio, because the wavelengths were shorter than they used before, and it changed everything. Soon the phenomena was better understood to have been caused by reflection of the waves from a layer in the atmosphere called the Ionosphere.(Called the Sky Wave mode). For a tutorial, see the appendix, 'How HF radio works'.

Naturally the Marine Radio people were interested and soon utilised the Sky Wave mode for Marine Radio use, which is how it still is today, with ships of the world communicating by Short Wave radio, now called High Frequency radio (HF radio). Ships send telegrams by Morse code, Teleprinter Over

Radio systems (TOR) or phone calls by Single Side Band (SSB) to especially set up radio stations back in their home country.

Historically these stations have usually been built near to coasts, so they are called Coast Stations, though now few of them are. The British coast station is known by the name "PORTISHEAD RADIO" (because it used to be in Portishead Nr. Bristol but is not now).³² There is a huge international network of these stations in most sea faring countries. The details of them can be found in the **Admiralty List of Signals** (HMSO) or the ITU List Of Coast Stations, which are like a phone directories for coast stations and contains their frequencies etc. It is best and cheapest to pass messages to the coast station nearest to where the message is going, preferably in the country to where the phone call is being placed.³³

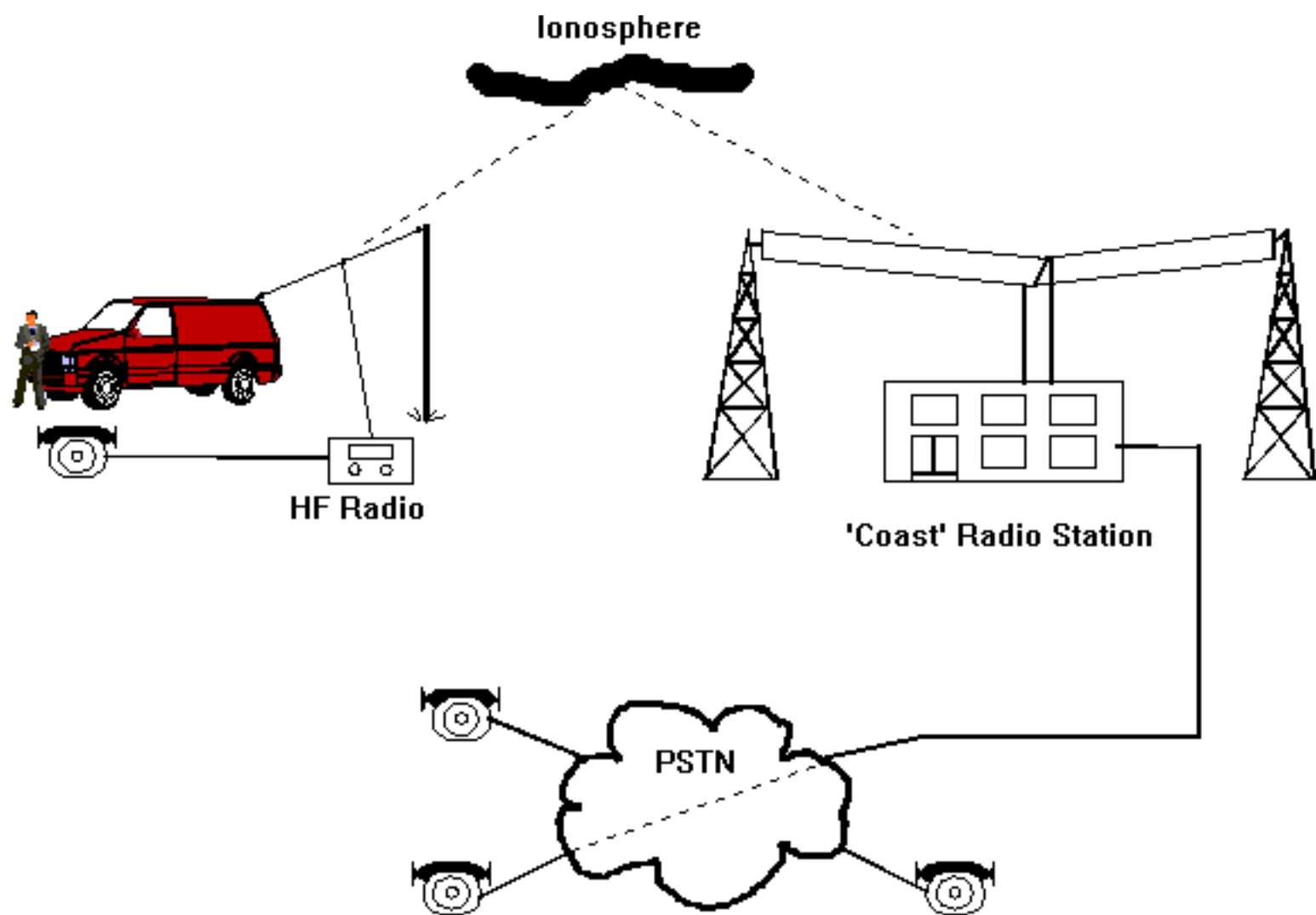


FIG 11 Coast Stations enable HF radios to 'plug in' to the PSTN, or TELEX network.

The Coast Station receives the message³⁴ and relays it via the International Telex network, or messages can be telephoned or FAXed to any number world-wide. When using the coast station's own ordinary phone lines, the coast station operator dials the shore phone number and connects the radio to the phone line over the PSTN, using a so called 'phone patch' circuit. This has been going on for years and they are very good at it.

Sadly, the ionosphere can vary a great deal in height, thickness, position and reflectiveness as it adapts, responding to solar flares and magnetic storms in space³⁵. This means that the right frequency to use to make the signal bounce down at Portishead keeps changing all day, and it has many other fickle tricks, some predictable some not.³⁶

Portishead knows this and counters by having transmitters available for use on all of the frequencies that are likely to work. But it is up to the skill and experience of the radio operator to choose and use the right frequency and right antenna.

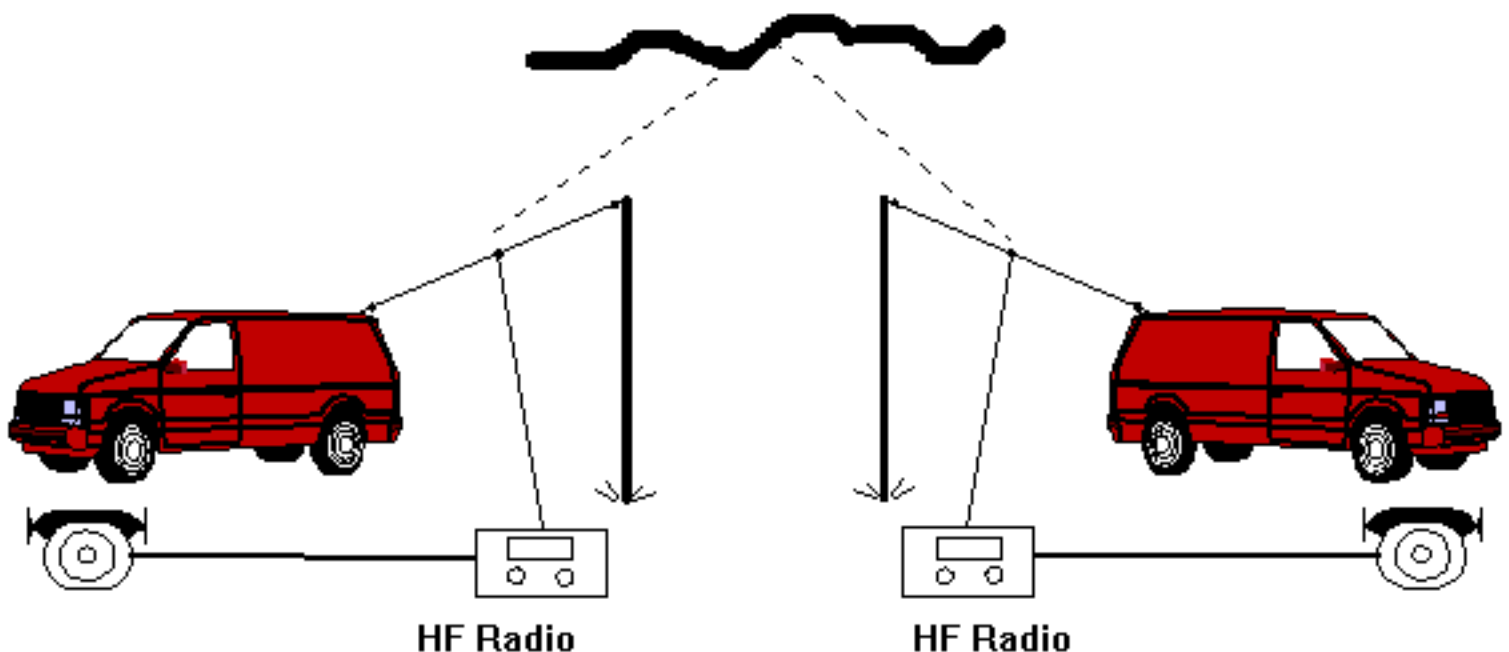
In short, though it will probably work at some time in the day,³⁷ it is only about 70%-80% reliable at any one particular time, with a 1% chance of not working at all, during a particular day, (about as reliable as the BBC World Service). A great deal depends on the training of the Radio Operator. Being a good Radio Operator is a Craft Skill and this explains why Amateur radio is a hobby and making 'phone calls isn't. Having said that, anyone can be taught the basics in a few hours of teaching plus some practice of their own and there is much satisfaction from doing it well.

Sadly, the whole marvellous effect drops off about 30MHZ and radio starts to act more like light again, working in straight lines, but able to permeate through walls better than light does. These frequencies are called VHF (Very High Frequency) because they were very high compared to what Radio Officers were used to before.

The range of VHF is limited to a small region of between 5-50 km depending on the installation. UHF (Ultra High Frequency) bands have shorter range but are more reliable in a built up area as the waves tend to reflect off buildings and reach into dead spots better, so these tend to be used by 'walkie-talkies'. They are thus more for Local communications rather than global; VHF will be explained at more length in **PART 2** about local communications (range under 1000km) and not elaborated on further here.

3.1.2 HF RADIO EQUIPMENT

The equipment needed for all HF radio networks is substantially the same. This is good because the HF radio is a very flexible tool in the right hands. For instance, it can enable global intercontinental communications one moment, and be used for short distance local 'CB' style calls the next.



*FIG 12 HF radios can contact each other directly over thousands of km. This method is **FREE** of call charges.*

This ability is an advantage over INMARSAT terminals which charge for satellite usage. Thus when calling another terminal even 1km away from you as the crow flies, the charge is for two uses of the satellite.

The first thing needed is a Transmitter and Receiver. These days both devices are put into the same box, so they are called a Transceiver. The resulting device is usually about shoe-box sized, and weighs 5kg, plus power and antenna units.

What strikes fear into the hearts of most users is the constellations of knobs and lights on the front panel. This was done because in the old days, trained Radio Operators worked them, so manufacturers pandered to their tastes. Now however, the average user is a yachtsman or aid worker, so the manufacturers have replied by building much simpler controls.

Beware however that some of the most popular and heavily advertised radio sets for the non-consumer electronics market, such as yachtsmen, have a bad record in the harsh and rough conditions of disaster sites, made worse by tropical humidity. User experiences should be paramount in selecting equipment.

Older radios tended to have their tuning fixed by 'crystals' and it was the job of an expert to tune such a radio. Today most radios are tuned by synthesizers, microchips which take orders from a telephone style keypad. Anyone who can dial a telephone number can programme the radio and adjusting the circuits inside is automatic, so how can you go wrong?³⁸

3.1.2.1 Modulation Modes

These days, most radios have a switch marked CW,SSB,FSK, or something like that. This control selects the way the signal is put on to the radio carrier wave. The carrier wave gets its name because it is like a carrier pigeon. Just as the message is strapped to the leg of the pigeon and the pigeon flies to the destination, so also the carrier wave travels to the receiver at the other end with the message 'strapped' to its leg by a process called 'modulation'.

At the other end, just as the pigeon is not the message and so is disregarded when the message has been removed from the leg, so also the message is removed from the carrier wave by a circuit called a 'Demodulator'. Unlike pigeons however, radios need different modulators depending on the type of message. Here are some of them but there are many more.

CW stands for Continuous Wave, and is for when using Morse code. You need to be an expert telegraphist to do this so you probably won't need this much. However if you wish to listen to the Beacons that Portishead has running to indicate which band is open, you may select CW or you may also select SSB for this purpose.

SSB stands for Single Side Band. This is the one you will normally use most. How it works is not important, but you can tell when it is being used by the Donald Duck quacking voice it produces if your receiver is not tuned correctly to the transmitter frequency. There is a control marked 'Clarifier' or 'RIT' to adjust the pitch of the received voice and make it sound more natural. SSB is by far the most common mode for speech on the HF bands today, because you can fit more SSB channels on a band than any other speech system.

One thing to watch out for is a control marked USB-LSB. This should normally be in the USB

position. The exception is when contacting an Amateur radio station on frequencies below 7.1 MHz, when LSB should be used. If you ever find that you just can't make Donald Duck make sense, try flicking this switch.

FSK stands for Frequency Shift Keying, and is used in conjunction with special circuits when sending **TELEX** or text messages by a system called Teleprinter Over Radio (TOR).³⁹ The field team would have a PC running special software to do this. The computer is then connected to a small box (or uses built-in circuits) which converts the text into a special signal suitable for sending over a HF radio link, even a very bad one.⁴⁰ The electronics in the TOR unit, called a Terminal Node Controller (TNC)⁴¹ make sure that the message is the same at both ends and is not corrupt.

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The CICR (International Red Cross/ Red Crescent) after many years of experience , have found Teleprinter Over Radio (TOR) to be the most acceptable to them. It has the text message advantages as outlined earlier, and is very reliable and cheap. Over the same radio path on a given day, TOR is able to read messages from a far-flung office when speech by SSB is near impossible to read.

Teleprinter Over Radio (TOR) is finding many friends these days so without going into details, here is an explanation of some of the modes of TOR. Incidentally, SITOR or Simplex teleprinter over radio is the same, as is AMTOR or Amateur Microprocessor Teleprinter Over Radio.

Automatic Repeat request mode (ARQ) is also known as Mode A. In this mode, the sending radio sends three letters of the message plus some check information. Then it listens for the terminal at the other end to check if what was received was any good. If all is OK then an acknowledgement message is sent from the other end. Our end then sends the next three letters.

If there is something wrong with the received letters though, the other end sends a request to repeat the last burst, hence this mode's name. This is the best mode because even if the channel is very bad with lots of interference, only a perfectly good message will be received at the other end. This happens **even if there is no one at the other end to work the controls**, which is excellent if you think that there may not always be someone to 'baby sit' a hissing radio all day, as is very often the case. ARQ is the method used for the public Telex system by Portishead radio and others.

The only problem is that this can only be done on a one to one basis. If you wish to send out a message to everyone at once on a certain radio channel, another method called Forward Error Correction or FEC, also known as Mode B is used. This method repeats everything and equipment at the receiver decides what to print or prints an error character when in doubt. This is not as good as ARQ and should only be used when you are sending a messages to more than one station.

Paktor is an interesting combination of Packet data and TOR systems. It offers more, faster and better functions than plain old TOR, for example it can use both upper case and lower case letters so you can send computer generated files. Some commercial coast stations use Paktor or variations of it in their public **TELEX** or data systems.

There is a further consideration of data modes in **part 2**, so we will come back to this later and press on with HF radio for now.

3.1.3 ANTENNAS

The big operational problem with H.F. radio is, the antenna system. Antennas must be resonant at the frequency being used. This gives two problems. First, they tend to be much bigger than say CB antennas, secondly, as we have explained, we need to keep changing frequency through the day, so we need to keep changing antenna size!

3.1.3.1 ATUs

In reality though, this is not done, but a device called an Antenna Tuning Unit (ATU) is installed in the cable from the radio to the antenna. The operation of this is usually automatic these days,^{42,43} but its disadvantage is that it can't make the antenna more efficient if it is off tune, so the antenna has to be resonant 'somewhere near' the frequency in use to be any good. Don't be tempted to let your ATU cure all of your antenna problems. ATUs won't make a bad antenna radiate better. The antenna is the most critical part of the set-up, pay attention to it if you value your communications links.

Some ATU's need special control signals from the radio.

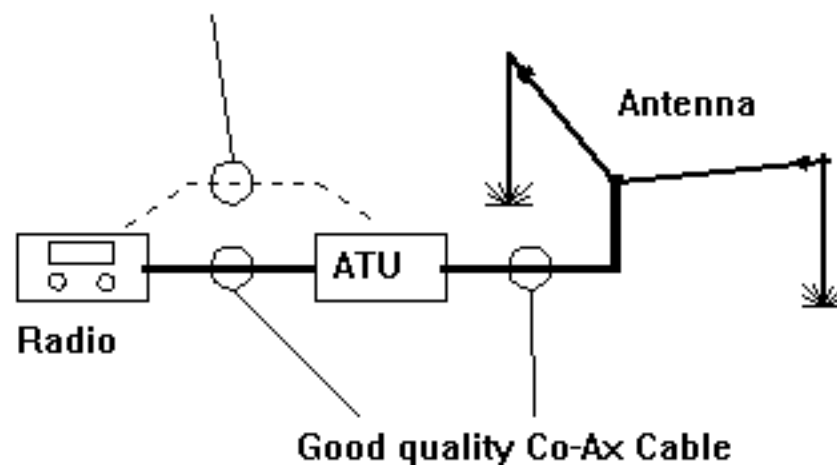


FIG 13 The position of an ATU.

Antenna manufacturers understand this, so they can make antennas that will be naturally resonant on several frequencies of your choice.

Here are some of the solutions you will hear about.

3.1.4 DIPOLES

These are simple looking but very effective pieces of wire, about 10-20m long, dangling from a handy tree or building. They can be wideband, Tuned or Multi-Band tuned by so called 'traps' (looking like bumps along the wire). The simplest types are just shortened or lengthened by reeling in or out from a bobbin once the frequency has been chosen. This is more fiddly, but makes a robust, compact and very cheap antenna.

Once reeled into the bobbins, the antenna is now about pocket book sized, which is very convenient for the team on the move.⁴⁴ This is the type used by the military Royal Signals, who swear by it, and have no plans to change to anything else. The DRCF also favour this method. The most practical general purpose configuration is the inverted vee, which needs support only at the centre and has no directional properties.

3.1.4.1 Widebanders

Widebanders are designed to be resonant on all HF bands. This makes tuning very simple, but has the disadvantage that some models can be rather long, about 30-50m , so you need to find space to string it up. A further problem is that they are so wideband that they tend to collect more noise for the receiver to handle, whereas narrow band antennas can help the receiver to be more sensitive by collecting less noise.

3.1.5 VERTICALS

These look a bit like knobbly aluminium flag poles, and are generally bolted to the roof or gables of a building, or can be placed on the ground. One good thing about them is that they take up little space (horizontally). Unfortunately they usually need guy ropes to hold them up and aid with the efficiency. They have to be assembled very carefully when packed away, and the operation of erecting the pole is critical if damage is to be avoided. So installing them is more difficult, but once installed they are quite effective and compact.

A favourite type of vertical antenna is the type mounted to the bumper or crash bar of a vehicle, called a mobile antenna. Models are available either manually tuneable by adjusting tappings or automatically tuneable by a servo motor in the base. These types must be extremely robust and so need fitting properly.

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Portishead radio reports that mobile stations in Africa and the middle east contact the UK directly with just a vertical mounted on the vehicle. However conditions have to be good for this to be possible.

3.1.6 BEAMS

Beams look like huge, droopy TV antennas. They are the type most used by Embassies and Red Cross HQ's. Their advantage is that they put a powerful signal only in the direction they are pointing, so you need to know this direction from the start. Alternatively you can have a Rotator, an electric motor with controls near the radio, to turn the beam in the direction you want to transmit. These are good and popular antennas, but they are even more difficult to put up than the verticals, so they should only be used at fixed or semi-fixed locations unless your technicians are well drilled.

3.1.7 LOOPS

These look like large hula- hoops and have a diameter of about 1m. Their advantage is that they are very compact indeed, about the same size as a 'Dish'. They tend to be used by radio Amateurs who live in blocks of flats, where it is against local planning regulations to install a larger model of antenna. The loop is just placed near to a window. They are easily the most compact antennas when erected. and their efficiency, while not nearly as good as the beam, is still fair, so the arrangement is highly practical. They have the further advantage that they are very narrow band tuned, resulting in much better receiver selectivity even in the face of severe local interference.

The disadvantage is that they will not pack down any smaller, so carrying them around is a bigger problem for those on the move. As they are so narrow band they have to have a remote tuning system as part of the kit. There is little practical experience of the use of loops in the field as yet, but my information is that the military, attracted by the mobility it affords, are impressed.

3.1.8 Multi antenna systems

None of the antennas mentioned so far are perfect for all uses, some are better for short range, some for long range, so you may decide on more than one antenna. In any case you should have at least one 'home made' wire type antenna which you can repair yourself with few resources as the final back up. Therefore you may decide on a co-ax switching system to select the best antenna. The eventual choice depends on how much you want to spend and how much weight and bulk you want to carry around. Every expert has his favourite antenna and a thousand reasons for you to purchase only his type.

We are on the move and literally carrying every ounce of ironmongery with our own back, so I say, keep it simple.

Now that we have our transceiver set up, let us think how to use it to the best advantage. We will now consider the Networks open for HF radio users.

3.2 MARINE RADIO (MARITIME RADIO COMMUNICATIONS SERVICE)

The Marine Radio system means using our radio in the field to contact a coast station such as Portishead Radio.⁴⁵ The advantages of doing so are many.

Marine coast radio stations are very fine establishments, very professional both in the excellent equipment they use and in the highly qualified and experienced staff they choose as Radio Officers.

For example, their receiving stations are situated far away from their transmitting stations, so there is no interference from their own transmitters, and this enables them to use very high gain receiving antennas and very sensitive receivers. The result is that even if you in the field are using very low power equipment and a makeshift antenna, they can boost your signal to make it sound stronger. Their transmitters are powerful and their antennas huge and very impressive. (you can see them when travelling from the M1 to the M6, the large masts and antennas on the left).⁴⁶

This means that with quite modest equipment in the field, your signal will still be readable in the UK and therefore a quite readable phone call is possible.⁴⁷

Their staff are very experienced and very helpful and friendly. They will gladly give advice if they think another channel is better. They are very easy going and will be patient if the operator can't use perfectly correct procedures.

They can offer several services,

- PHONE CALLS

To or from any phone in the world on the PSTN. These can be connected manually by Portishead radio, requiring only very basic mobile equipment or by a semi-automatic system called AUTOLINK, which costs about PS350.00 more but gives 20% savings on phone charges. Scramblers can be arranged if security is required.

- TELEX

For stations equipped with a special unit (TOR SYSTEM) a full duplex (chat back and forth in real time) automatic dial in and out public global Telex system. It is said to be very reliable by those who have used it and has the advantage that it can be left unattended.

- PHONETEX

This means they will accept a telex or telegram dictated by you over the radio with your ordinary microphone. **No special equipment is needed.** Portishead will then send it or FAX it for you.

The reverse is also true, they will hold messages for you, TELEX phoned in messages, FAXes etc. and then dictate them to you when you call in, however they do charge for this service.

This is excellent because the personnel in the field may only be able to set up equipment when not moving or otherwise busy. Also power requirements may be the primary influence on when they can call in. This may not be when the office is open or when the called person is available in which case Portishead is acting as a message bureau, saving messages until the team are able to call in.

- RADIO TELEX LETTER (RTL)

Messages from radiotelex stations can be sent to Portishead from where they will be forwarded by mail. Greetings Telex letters (GTL) to celebrate, for example births and weddings, are available in various designs of card.

- DIRECT BILLING

This means that phone calls to one number can be billed to another. This is ideal for personal calls or calls where the caller will not be billed by the Radio Operator at the sending station.

- INFORMATION SERVICES

Mostly of interest to TELEX users, a database of various information such as best frequencies to use, exchange rates etc.

- RADIO MEDICAL SERVICES,

FREE medical advice by doctors connected by line from Portishead.

3.2.2 HOW IT IS USED

The Radio Operator in the field has only to tune to one of Portishead's frequencies and call him up. The operator must use his skill and experience to choose which band will be the best one, see 'how HF radio works' in the appendix.

The best way, is to listen to the BBC World Service, then use the nearest Portishead frequency to the strongest BBC frequency. Also you could read the Morse code 'beacons' that Portishead has running to give away which band is open. Or you could listen for the traffic list which sounds the clearest.⁴⁸

The operator will then tune in his antenna and after consulting a simple table, type in the frequencies into the transceiver.

To call in, you just press the button on the Microphone and say.. "Portishead Radio.., this is 'Aidcamp Base' on 10.291...Over". Always indicate which frequency you are calling on as the Radio Officer will be listening to several speakers at once and maybe missed which one your voice came out of.

If he doesn't get through, well he can just try again on a different band. When he does get through, after quoting his callsign, Portishead will tell him if there are any messages for him.

When a landline PSTN caller wishes to call a mobile station, he simply phones Portishead radio and quotes the callsign of the mobile station concerned. If the mobile is expecting a message, he may wait on the main frequency if he wishes, in which case the call will be passed straight through. Otherwise a Booking is made and the call will be put through when the mobile unit calls in.

TELEX calls from a landline telex to a mobile are made by TELEXing Portishead radio and typing in the callsign of the mobile. If the mobile is ready, then the message will be put through immediately, even a two way conversation could be held. If the mobile can't be contacted (for example if it is switched off) the message will be kept in Portishead's computer and passed on to the mobile when he next calls in on a store and forward basis..

3.2.3 FOR MARINE RADIO

The main advantage is cheapness of service and convenience of equipment. Typical HF radio equipment is about PS 1,000-3,000. (very much cheaper than satellite).

The services provided by the coast stations are also cheaper, for example phone calls are about PS 2.75 per min. Telexes are about PS 3-5 per average message to send. Typical HF radio gear is about the size of two large shoe boxes and weighs about 3-5KG. There are also no standing or monthly charges to pay, its strictly pay-as-you-use, which is attractive to occasional users. There is no charge for opening an account, and this can be done in five minutes by exchange of FAX application form.

3.2.4 AGAINST MARINE RADIO

As an HF radio service, it can only work when the Ionosphere will allow. To use the service you will have to open an account with an international accounting company or directly with your coast station (though in an emergency or disaster this can be waived).

Not only are HF radios themselves fairly user unfriendly, but the user has to listen around the bands for the best frequency to use, and so some operator training is required for the best results.

Unlike a normal telephone connection, the charging for the call is from when the called person answers to when the CALLED person hangs up. Don't let the landline side waffle on at huge expense, set yourself a time limit for the call and say at the start of the call 'I have 5 minutes'.⁴⁹ Actually you have as much time as you like but this will trigger the landline user's mind into a more concentrated mode and prevent him from 'waffling' or becoming overawed at such a novelty.

When you are happy that the call is over, tell the landline caller very firmly, 'PLEASE HANG UP NOW'. You meanwhile keep listening on the channel so Portishead can tell you the charge for the call, which you should record in your log book.

Lastly, the transceivers used on Marine service must be capable of split frequency (DUPLEX OR SEMI-DUPLEX) operation.

3.2.5 FOR AUTOLINK

Also by Portishead radio, and other coast stations such as Cape Town Radio (with other versions from other stations such as the AT&T High seas service) Autolink is a semi-automatic direct dial system for HF radio. By means of special equipment which is linked up to the radio, a user can dial up the phone number required himself by the buttons on a mobile-phone style handset. This has the advantage that

it is a little quicker but the biggest advantage is that the call charges are about 20% lower because there is no need for a Radio Officer to dial the number for you.

3.2.6 AGAINST AUTOLINK

The first problem is that the automatic system does not operate the radio itself, so the user still needs to use all his skills to select the right band, right frequencies, right mode and tune the antenna before Autolink will work. Experience has shown that it is easily disturbed by noise and static on the band so is not recommended for very long range use on frequencies above 6 MHZ.

3.3 GATEWAY SERVICES

It's Portishead radio again but by another name. It is also known as the '**Aeronautical Service**', but do not be confused by this heading on the frequency tables, it is exactly the same as Gateway. The service is intended for use by Aircraft on Oceanic passage. The Pilots pass position reports and ETAs to the ground at Portishead by SSB. The pilots can be connected by 'Phone patch' to their operations room to discuss operational problems. **Some of the HF frequencies are exclusive to this use and intruders would not be welcome.**(These are marked with an asterisk on the tables).

Some however are set aside for private phone patches and chit-chat and these can be used by anyone else.

*NOTE

Actually, BT is now taking the view that a Gateway customer is anyone other than a traditional Marine Radio Customer. In fact, a Gateway caller is just as welcome to call on a Marine frequency. Gateway customers can also use TELEX or PAKTEL data modes if they have the special equipment.

3.3.1 FOR GATEWAY

The main difference is that Gateway customers may use the aeronautical channels which are SIMPLEX SSB (speech only). This means that the system can be used by older more basic radio equipment which may not be capable of DUPLEX operation. In addition the Aeronautical frequency bands are in different places to the Marine ones. So if you cannot get through on a Marine frequency, perhaps an Aeronautical channel will be better.

3.3.2 AGAINST GATEWAY

Gateway is a 'Simplex' system. This means that only one person at a time can talk, the other must listen. At the mobile station in the field, this is done by pressing a button called the 'press to talk' button on the microphone. Therefore the landline side user needs to understand the rules and keep disciplined, never interrupting the mobile user.⁵⁰ To avoid confusion, it is best to say 'Over' when you have finished what you have to say. You are charged for the call until the called party hangs up, so say 'Hang up now' when finished.

3.4 Amateur Radio Service

Amateur radio, also known as Ham radio in the USA, does not refer to special radios at such but to a special set of rules which apply to certain frequencies as defined by the International Telecommunications Union. (ITU). The rules allow these frequencies to be used for research, education and personal use by private persons, (as opposed to commercial institutions).

The word Amateur in the title implies the use of radiocommunications for non-commercial uses, not to the fact that many Radio Amateurs are not professional radiocommunications people, though just as many are. In fact many of the worlds most revered scientist and engineers are radio Amateurs. Many more would not be where they are today if the Amateur service had not provided them with a platform to learn their craft as unknown youths.

Many are drawn to Amateur radio for sport, recreation or the unique form of social contact it can bring. However many very important radiocommunications systems in use today, were developed by private individuals (some of whom were also professionals acting in a private capacity) using the Amateur bands. To make this possible, the rules about what can and can't be done on these bands are as loose as can be consistent with preserving the rights of other users. For example there is no type approval requirement in order that new experimental types of transmitter and receiver can be built and developed even though legislation has not caught up with it yet.

Obviously this could be a recipe for disaster if there were not some kind of requirement that the holders of licences on the Amateur bands are required to pass exams in basic electronics and radio law. The purpose of the exams is not to preclude anything less than whizz kids, but to be sure that the prospective holder of such powerful tools understands the potential for interference to others that bad operating can so easily cause.

Having passed the exam, the person is issued with a certificate, which is valid for life. He can at any time use this certificate to obtain an Amateur Radio Licence. Persons holding a licence to operate on the Amateur radio bands are called Radio Amateurs. In many countries, there are more than one different class of Amateur licence. In Britain for example, there is a novice licence, Class B and Class A. Novice licences are intended for the very young or very new operators, and are intended to be a temporary step to a class B licence.

Class B licence holders pass two exams, one in radiocommunications technology and one on radio law and regulations. However they are also only allowed to operate of frequencies above 50MHZ, so they cannot use HF radio frequencies.

Class A operators have rights to use the HF radio spectrum, with its very useful sky wave mode, enabling global communications. Class A is the top class, so this is the type of licence you would preferably look for in an operator intended to help with disaster communications.

In addition to purely technical reasons, most governments expect their Amateurs to provide emergency communications in the case of an emergency or disaster. Yugoslavia, Caribbean hurricanes and many more cases show Amateur radio will work when nothing else will. This is because HF radio does not use the ground based bearer network, and has power requirements modest enough to be met with batteries and generators. Therefore it is probable that your local Amateur is in contact with the local police or civil defence establishment, and is able to traffic messages around the area for you quite effectively.

Amateur radio is an unbeatable way of learning about radiocommunications, first hand and hands on, so I strongly recommend that anyone wanting to learn about it should obtain a Amateur licence. Not

only will you learn much, but also you will meet many people who can be of help you, and be able to set up do-it-yourself communications if you get stuck.

3.4.1 Resolution 640

Resolution 640 of the ITU WARC Geneva convention 1979 is explained in greater depth in chapter 5. It is very important to us because it enables third party trafficking, meaning that Amateurs can traffic our messages on their radios. Though in normal situations Amateurs are forbidden to pass messages on behalf of a third party, or to talk to a non-amateur station, this can be waived in the case of a disaster if the host government has regulations permitting this and permanently allows and encourages it. This is a theme that needs expanding on much more, so I will return to it in chapter 5.

3.4.2 For Amateur Radio

It's free to use and relatively cheap to buy the equipment. It does not depend on any ground infrastructure and so it may be the only thing working in the area. If you invoke ITU Resolution 640 it can provide the least administrative and legal hurdles. It provides a common pool of frequencies both in the HF bands and the VHF and UHF bands, overcoming the severe problems when working with other organisations. However resolution 640 does not allow the use of equipment without a licence from the country in which it is operating. Most experts agree that Amateurs are the most skilful operators of their equipment.

Many governments encourage their local Amateurs to set up and practice emergency networks. In the USA, for instance, the Government allows the Radio Amateur Civil Emergency Service (RACES) and the Amateur Radio Emergency Service (ARES) to practice as much as twice per month. The more practice time a government allows, the better will be the morale, skill and preparedness of the local net.

3.4.3 Against Amateur Radio

Amateur radio networks are rather nebulous things and so you are very much at the mercy of the locals, (unless you provide your own equipment and operators). Amateurs are volunteers and so you have no rights to demand anything from them, you must keep their good will. It is best to have an Amateur along with you who can speak their 'language' and make them feel happy to work with you.

One serious problem is that of confidentiality. The Radio Operators working with you are unlikely to embarrass you, but many others will be listening in with great interest. It will be like doing your housework in the town square, with passing strangers looking on.

Ideally you would like to solve this problem by using data systems such as packet radio, in which case you would want to scramble the data before sending. The problem is that it is strictly forbidden for an Amateur station to send messages in anything other than 'plain language'. By contrast, your organisation rule book may insist that you preserve the confidentiality of those you are serving, making passing such information in such a public forum out of the question. This issue means that the use of Amateur radio may be limited to logistical matters, but in any case this will depend on what the policy of your organisation is, how urgent your need is, and if there is any other choice.

A further problem is that amateur networks are designed to relay written messages from net to net until they arrive at their destination. It takes quite some minutes for even a simple message to be spoken over the air, written down, checked, and spoken again to the next net controller etc. until the

message arrives at the addressee. If this requires, for example, four repetitions of the message, then it can take 20-30 minutes to ask a question and get a reply. Again, packet operation improves this situation.

3.5 'Private' HF radio networks

This means that you own both the mobile station and the 'coast station'. In fact your mobiles communicate only with their own base station. The attraction with this idea is that there are no call costs at all, only the capital costs of the equipment needed.

Unfortunately there are many snags, the biggest of which is getting a licence for the equipment you wish to install and a frequency allocation. Such networks are a very good idea for networks within a given country or region where the frequencies given by the government may be quite adequate for communicating over 1000km or less; for global intercontinental communications you would need to have channels in many bands to ensure reliability.

You would need to have permission from the countries at both ends of the link for the use of the same frequencies and at the same time. This is a problem because channels are often allocated on a time share basis. Demand for HF channels is huge and the competition very fierce. You would be very lucky indeed to get a private allocation that would be half way near any good. Then you would need to set up your own base station at the office. Not only would this be very expensive, and not nearly as good as a professional coast station but also you would have to find skilled radio operators to monitor the system round the clock.^{51,52}

=Report=Report=

The Red Cross and the UN have private HF radio networks. They use them in the PACTOR mode for passing low priority e-mail messages from office to office. The use of satellite equipment means that very urgent messages are no longer transmitted by HF radio. Therefore there is no need to build very powerful transmitters and high gain antennas in order to cater for 24HR operation (as was formerly done at great cost). Instead, much more modest equipment of a few hundred watts and simple antenna systems are now used. Since low priority electronic mail is transmitted this way, we can afford to wait for propagation to open a channel, even if this takes all day. The system stores outgoing messages until a band opens, then automatically sends them over the first available open band. The clear advantage is cost. There is no call charge to pay other than the first cost of the equipment and the maintenance of the very simple system.

Despite the seeming attractions of private global⁵³ network, few experts advise it because the coast station fees will amount to less than the cost of running your own network. but if you think that the volume of traffic is fairly high, get a good consultant to study the feasibility of so doing. Frankly I wouldn't unless you are really serious.

³²The British long-range HF radio station is known as 'Portishead Radio' and is located at Highbridge in Somerset. The original transmitting site at Portishead near Bristol was closed in 1979 but the name has been kept.

³³Information relating to Portishead radio is similar to services offered by other coast station of other nationalities. Check with your national marine and aeronautical service for details.

³⁴The messages are either automatically or manually typed into a computer VDU. The computer then tracks the message to ensure that it is not lost and is passed on as soon as possible.

³⁵Many of these phenomena are still a mystery but the greatest effects seem related to sun spots. Therefore you may see some propagation documents mention the sun spot number.

³⁶You can receive predictions of propagation from Portishead Radio either as charts or by automatic telex data bank.

³⁷The actual figure depends on the path between the coast station and the field team. More accurate estimates can be obtained from coast stations or other expert consultants. In any case the path is much more reliable for working through a coast station than for working from mobile to mobile or mobile to base. This is because coast stations have highly superior antennas and receivers and they have more frequency bands at their disposal.

³⁸Actually some countries forbid the use of synthesised radios unless the programming can only be done by an expert technician in a workshop, leaving the user with only a channel selection knob.

³⁹Also known as TOR, it is the same as Amateur Microprocessor Teledata over Radio (AMTOR).

⁴⁰Experts reckon SITOR to be the most reliable HF radio system yet devised.

⁴¹Or just a modem

⁴²There are manually operated ATUs available from several sources. They are very much smaller, lighter and cheaper than the automatic versions. but you have to remember to tune them when you change frequency. Tuning can be tricky and so an operator has to be shown how to do this.

⁴³Some models of automatic ATU need special control cables from the transceiver. Often they will work only with a particular model of transceiver so beware!

⁴⁴However one model has the driving loop made of a soft band instead of a solid tube. This make it easier to pack but the makers don't recommend regular flexing of the loop.

⁴⁵For your best Coast Station consult your national PTT. A full list can be found in the book 'Admiralty List Of Signals' published by HMSO (the British government press).

⁴⁶The antenna systems in use at Portishead Radio consist of omnidirectional transmitting aerials (for Morse code and Telex operation and rotateable log periodic (RLP) directional antennas for voice communication. The output power is in the region of 10KW per transmitter. The transmitter site is located at Rugby, Warwickshire. The receiving aerials are located at Somerton near Yeovil in Somerset, and are highly directional rhombics spaced every 15 degrees. The direction of the aerials is controlled by the Radio Officer at the Portishead control room in Highbridge.

⁴⁷The performance can be better than that of a much closer base station with less advanced equipment.

⁴⁸A Traffic list is a list of mobiles that the coast station has calls from PSTN pending. It is broadcast on several frequencies at the same time, Usually the main frequency in each band. This is usually done every hour on the hour so listening to all of them will quickly show which band is the strongest signal. This is one advantage of having Receivers with memory settings as you may miss the list if you take too long to tune to the next band manually.

⁴⁹You can get Portishead to remind you when a certain time is up. This helps you to control your

spending. Inmarsat do not offer this service at all.

⁵⁰A good trick is for the landline user to cover the Mic. on the telephone when listening. This prevents noises in the room from cutting off the incoming voice.

⁵¹The CICR has a whole department based at Geneva staffed with many technicians devoted to this task. They have sufficiently high levels of traffic to justify the costs of such an arrangement. Also they have the luxury of having several frequencies assigned to them but not on an absolutely private basis.

⁵²UNDHA uses the transmitters of the Swiss PTT on a permanent lease basis.

⁵³When running local networks within the region, private base stations make much more sense and in any case may be the only alternative.

CHAPTER 4

4 Power

Despite the glamour of the satellite dish and the lap-top personal communicator, they are all 'so-much-junk' without electrical power. As you are reading this now, think how far away you are from its subtle pervasiveness, the lights, your watch. The human mind is designed to flag up unusual or changing things to our consciousness, so no wonder few give thought to something that is always there.

Yet as disaster workers, we are going somewhere where we cannot expect the power sockets to work, for the same reasons as the telephone sockets will not work. The factors causing loss of one will cause loss of the other, so if it is necessary to spend all this money of communications equipment, you can be sure that you will need to bring your own power too.

You will soon become as obsessive about power budgeting as your accountant is about balancing his books. This is no exaggeration, when you have run out of power, you will have egg all over your face. It's a very lonely feeling.

And it's grim news. After the glory of the achievements in communications technology, prepare to come back to earth with a bump.

4.1.1 Batteries

Batteries are not the solution . They merely postpone the problem, not solve it.⁵⁴

On average, they will last for a day's operation, then they will need charging. So you now need a battery charger. Then you need power to feed the battery charger. Without sockets, you need a generator to provide this power, so we are right back to square one, and so soon too.

We will have to discuss generators later, but bearing this important point in mind, let us look at batteries and modes of using them.

4.1.2 Vehicle batteries

We can take it almost for granted that the field team will at some stage or all stages have access to a motor vehicle such as a land rover or a lorry. If so we have our two most important resources, a generator and a battery.

The 12V from the vehicle battery has become an important standard power input for portable electronic equipment and I have seen only a few devices that will not accept this input.

For example, an HF radio can be connected to a thick red and black cable which can be clipped onto the vehicle battery by crocodile clips, **be warned that some lorries use 24V batteries, in which case check with someone who knows how to 'tap off' 12V, polarities also vary so do check.** Batteries give an electrically smooth and well regulated output, so equipment always performs well when so connected.

You could rightly expect a whole day's work from such an arrangement and it has the advantage that no extra money has to be spent and no extra weight is carried as part of the comms gear.

When using satellite gear however, the current drain is much more and extra care is needed not to flatten the battery sooner than expected. Some more modern satellite gear has built in batteries, which if flat, will suck power out of the vehicle battery to replenish themselves.

In addition, if you have a more advanced set up, with computers, printers and FAXes for example, all of these will draw quite a lot of current so that the total power used may come up an amount similar to leaving the headlights on, on the vehicle. We have all experienced the consequences of that.

You will not be able to start the vehicle because the battery is flat.⁵⁵ You are now stuck miles from anywhere unable to move and just waiting for someone else to give you a jump start. You will find the AA's response time quite slow in some places in the world and anyway you can't call for help because you let your battery go flat and your communications gear wont work.

Also, it is damaging to allow the Lead Acid type of batteries as used in vehicles to stay flat for very long, as this reduces the life of the battery. Your driver knows this and will think twice before allowing you to ruin his battery again.

Get your power budget wrong and you loose lots of the friends who you came out here to help.

The obvious solution is to make sure that the engine is run regularly, say every one or two hours to keep the battery safely topped up, not only enough to run the radio, but enough to turn over a reluctant and heavy engine (which requires much more power). If in doubt, you can run the engine all the time you have equipment switched on. This however has the problem of noise and fumes which is only a problem if this is done for longer than a few hours.

The other problem is that this is a very inefficient way of using the vehicle's generator, so you will use a lot of fuel very quickly this way. This will bring you to a fuel budgeting crisis and add another headache to the list.

4.1.3 Dual Battery schemes

A good solution is to have two batteries on the vehicle, one connected to the vehicle electrical system and one to your external loads. These two batteries must have a switch between them. This means that you must remember to open the switch when operating the equipment (or else you will flatten both batteries) and remember to close it only when the engine has been started and is running (or you will not be charging the comms battery). Automatic contactors can be fitted to do the thinking for you, but again someone needs to think of that as they are not fitted as standard on most vehicles and retrofitting in the field may be impractical.

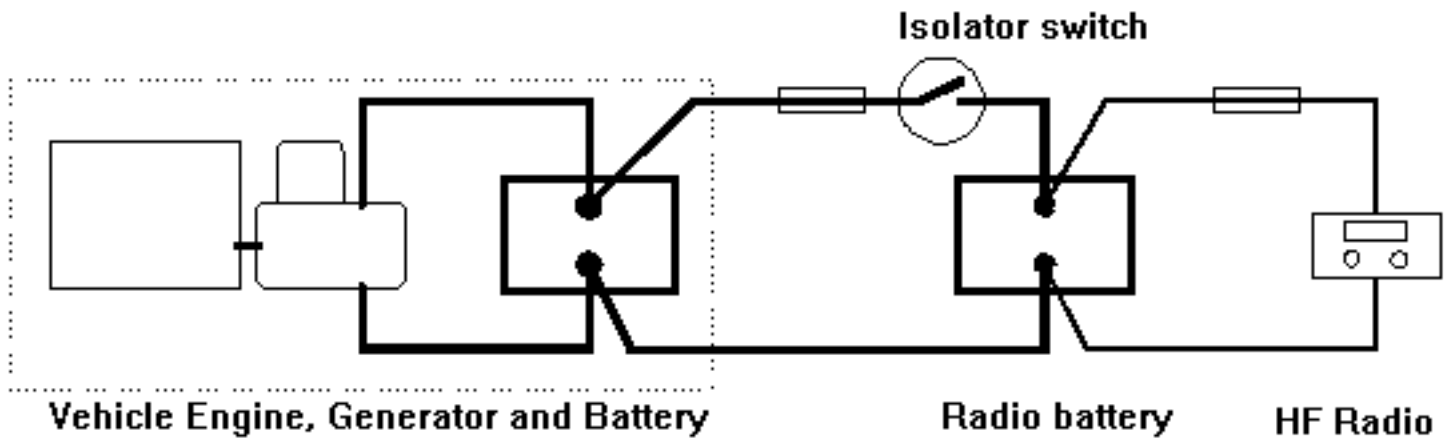


FIG 14 Dual battery schemes prevent vehicle battery flattening but rely on the operator remembering when to operate the switch

4.1.4 Power Banks

A further variant is to use one of the excellent propriety portable 'power banks' sold to handymen and yachtsmen. These are just 'car' batteries in a carry bag, but often have battery chargers or more advanced regulators built in to them. They have the further advantage that they can be carried away from the vehicle and used in a more convenient position, closer to the control tent or better for the antenna.

Also it is impossible to flatten the precious vehicle battery this way, provided it is disconnected from the vehicle battery when supplying the load. Of course, sooner or later they will need charging again.

4.1.5 Portable battery packs

These days, most portable gear has its own built in battery pack. The Lap top computer that I am using right now has quite a good one. It can run the computer for 4 hours before giving up, and can fully charge in one hour.

The very impressive briefcase sized INMARSAT-M satellite phone and INMARSAT C gear is another example. They can give about one hours talk time and 8 hours standby time on one charging and can hold their charge for some months.

The batteries usually used in these devices are a type called Nickel Cadmium batteries, or NiCad's for short (pronounced n-eye-kad).⁵⁶ They are wonderful for what they do, very light and compact compared to the lead acid type of car battery, but they have some tendencies that you should be aware of.

With the more expensive type of chargers, NiCads can be safely charged up in one or two hours but you must use only the charger that the maker recommends for each unit. The cheaper type of charger, the trickle charger type, may take up to 8 or 16 hours to charge up a battery pack.

In addition, with the cheaper chargers it is dangerous to the battery's chemistry to leave a battery on charge for over 16 hrs so someone must keep an eye on all the batteries being charged and know when they have had enough. If you don't have the time, or you don't expect the electricity to be on for that long, then you must pay for the proper makers battery charger.

Once charged, the NiCad battery loses about 10% of its charge in the first 24hrs, then about 10% per month. So when in use regularly, it is very good at keeping charge. This type of battery is very forgiving of being allowed to go flat on an occasional basis, as long as it gets charged up again soon.

4.1.6 Maintenance

The big problem with this type of battery is when the equipment is in storage. After an exciting and exhausting operation, who wants to go down to the warehouse and charge batteries? yet someone must. NiCads become damaged if they are allowed to be flat for many weeks, and go flat they will at the rate of 10% per month. Someone needs to visit the equipment on a regular basis and 'exercise' the batteries.

Exercising involves a regime of charging the battery, using the device until the battery has been well used, but not absolutely flattened, then charging the battery again. Spare batteries should always be purchased and these too will need exercising.

After exercising, the battery should be disconnected from its device during storage. A clear note to that effect should be put in a prominent place in the device so that if another user grabs the device and tries to use it in a hurry, he will be able to work out why it is not working and fix it. Sounds silly, but we have come across it.

It is plain that someone responsible must know the devices and their batteries and maintain them faithfully at least every 3 months. Someone in high authority must check that this is being done or you will find your expensive purchase, on which you have pinned so many hopes, lets you down when you need it most. Don't forget that all this applies to the computers, printers and FAXes as well as walkie talkies etc. that you expect to use.

=REPORT=REPORT=

The DRCF have such a regular maintenance system, and have been most grateful for it, as experience shows that anything not exercised regularly will let you down. The maintenance also involves testing the whole device so that faults can be picked up and fixed. Missing manuals must be found and placed in the box with the device. Otherwise, an operation starts and someone is sent out with faulty equipment that he can't understand. Be warned that equipment will pick up faults even when in storage. Neglect your equipment and it will neglect you. You will be embarrassed, frustrated and wish, wish, wish, that you had checked, checked, checked.

4.2 Power Supply Systems

All of the equipment needed to provide power is called the Power Supply System. The power supply system means such things as the generators, batteries, battery chargers, Power Supply Units, Inverters, voltage regulators⁵⁷ and other odds and ends that are not really part of the radios, satellite terminals or other devices as such, but are parts of the system that supply the power to them.

Many devices use electrical current in bursts. An HF radio for example is using a lot of current when you are speaking, but very little when you are breathing and listening. INMARSAT-C terminals send the data to the satellite in short but very powerful bursts, rather like a flash gun.

Let's take a closer look at the differences between the units of the Power Supply system.

4.2.1 Battery chargers

Some battery chargers are designed to charge the NiCad battery up to nearly full power in a few hours then switch off when the battery is fully charged, thus preventing overcharging and damaging the battery. This is done by high tech. tricks, such as alternate charge/discharge current pulses and the resulting charger can be quite expensive. However you should do a quick charge only with the charger the manufacturer recommends.

4.2.2 Trickle Charger

Or, you can charge at a quite slow and steady rate. This is called trickle charging. These chargers are much smaller and cheaper. They rarely have automatic shut-off function though, you need to make sure that the batteries are not left on charge for more than 16 hours. On the other hand, Lead Acid types can be trickle charged indefinitely without damage.

If you have a trickle charger, you must make sure that the device that the battery is charging is switched off. Sudden and large bursts of current demand from the device may blow up the trickle charger, meaning that you have just one more day at the most to use your device.

4.2.3 Float Charging

If the battery is kept well charged up, it is safe to leave the charger connected and the device switched on as the battery will supply the bursts of current needed. This is called 'Float Charging' but you should check with the maker if float charging is safe for a particular charger.

4.2.4 Power Supply Units

While float charging is the best from the point of view of reliability, they do require the weight of a battery. If you think that your mains power is reliable enough, then Power Supply Units are much better than trickle chargers. These are designed to provide all of the power that the device needs, as a replacement for batteries (sometimes they are called a battery eliminator).

In some designs of device however, there are hidden automatic switches on the plug where you plug in the PSU, which disconnect the battery from both the device and the PSU. As the battery is now disconnected, it may not be charging, when you would think that the PSU may be charging the battery at the same time as powering the device. The only way to be sure, is to consult the makers instruction book, or if in doubt, charge the battery on its charger while using the device via its PSU.

However you must be aware of one thing when choosing a PSU. If you look at the plate or label on the side of the device, you will see the power rating of that device. But this is the average rating, averaged over several minutes. The power supply needs to have enough 'guts' to power the device at its peak of output power, or else it will blow a fuse.

To illustrate; Suppose I have a very powerful spotlight above my garage, say 1000 watts. Now suppose that I switch it on for only 6 seconds every minute. The average power over that minute is one tenth of the rating of the bulb, 100 Watts. If I were to use a fuse rated for a 100 Watt load, it would keep blowing every time I switch the light on.

This is just what is happening in the INMARSAT-C unit for example. After you have typed and sent

the message, the Transceiver unit chops the message up into small packets, then fires them at the satellite with short but powerful bursts. Just like a flash on a camera, it cannot do this continuously, but must wait before firing another burst.

The power supply unit must be able to supply the Peak Load that the device will demand or else it will keep blowing a fuse. If you do not know the peak load current of a device, ask the manufacturer's technical department or check for a peak load figure on the specification sheet.

Not every manufacturer sells a proper peak load PSU with his device, so you should check your battery charger and make sure the people using the device know if the device should be switched off during charging to protect the battery charger. Check with your manufacturer for details, or better still, specify a good PSU when ordering the equipment.

4.2.4.1 Caveat

Designers sometimes make their devices seem much smaller and lighter, by having an external PSU. A salesman will have to work harder to sell an obviously heavier and larger device than for the smaller one. So ask your salesman awkward questions about chargers and PSUs before he adds up the 'little extras' and you find your costs much larger than you were led to believe.

Another point is that I have seen many very smart looking set-ups with everything in a fashionable briefcase. The problem is that the external PSUs don't always fit in to them so you also have to carry an awkward bunch of cables and chunky black boxes in another heavy bag. Chargers are much lighter and smaller than PSUs and this needs bearing in mind too as PSUs can be nearly as big and heavy as the device they are supposed to power.

On the other hand, if you think that you are going to be using the equipment for short periods of time and charging them most of the time, then a much cheaper trickle charger may be good enough.

4.3.1 Inverter

As I said earlier, there are still some devices that will require Mains AC power, some models of INMARSAT-A for example. This also applies to devices that were never intended to be portable when first designed, such as computer printers or Fax machines. What we need is a device to turn 12V DC into 220V AC in sufficient quantities to drive the power thirsty devices usually associated with mains powered devices.

And here is a warning. When a circuit designer starts his design, he has a power budget just as he has a cost and weight budget and a time scale. His design will be a compromise between these factors. Mains driven devices usually have power budgeting on a low priority just because mains power is considered a virtual bottomless pit, so beware and check the idle power usage of the device as well as the operating power usage of it.

Remember we are about to connect these devices to a battery, definitely not a bottomless pit of power. When you connect an inverter to a battery, let alarm bells ring in your mind. Budget carefully and also remember that the inverter itself uses some power even if no device is drawing current from it. Another problem is the annoying whining noise they make, like a mad mosquito (jokingly called vintage inverter wine).

Also, in some older designs, the 'waveform' from an inverter may be poor, so some devices will themselves make a whining noise, and a few very sensitive devices may not work at all on an inverter.

4.3.2 Uninterruptable Power Supplies

Uninterruptable Power Supplies (UPS) are a combination of a battery charger, a battery and an inverter. It is not necessary to provide invertors to back-up devices that have their own batteries, so their Power Supply Units can be connected directly to the mains. But if your generator or source of mains power is not very reliable, and you have devices that need mains input then this may be for you.

In fact, short outages of power are not usually a big problem to most communications devices (apart from the nuisance). You will be out of contact until the power is restored, but when it is, your radio or terminal should bring itself back on line with the settings you had before the mains went off. This is possible because the computer memories inside these devices have their own very small battery to keep the memory alive (but sometimes for only a few hours).

Computers have a bigger problem. If you have any messages in the computer memory which have not been saved to disk, then they will be lost. When the power is restored, the computer will need time to boot up and then you will probably need to type in lots of instructions to restart the applications.

You must check that this has been done after every power outage, or you will not be able to receive incoming messages via computer when you may think that the terminal is working. INMARSAT C terminals may bring themselves back on line automatically (if set up so) but your computer may not unless you have written an appropriate 'autoexec.bat' file to make it do so. If you have a disk in drive A, to store the incoming messages, then the computer will fail to boot up because of a non system disk fault unless you place a system disc in drive A. Computers using UNIX operating systems should never be allowed to shut down as this could completely confuse the computer.

This is a nuisance only, if it only happens every few hours, but if the boys are changing the plugs and wires on the generator a lot, as they will in the first few hours of the operation, then you may have to do all of this every 15 mins.

In the UPS, the generator is connected to a battery charger. This in turn charges up a battery. The resulting 12V DC is then lead to an inverter which converts the DC to 220 v AC.

When the mains fails, the battery stops charging, but the inverter is still being fed by the DC from the battery so the AC 'mains' from the inverter is not affected for as long as the batteries hold out, usually about 4 hours. When the battery has discharged to a certain point, a control system will shut off the batteries to protect them from overdischarge.

Another advantage of the UPS is that the battery tends to even out the load on the generator so providing a smooth load current and avoiding 'popping' the circuit breakers on the generator.

UPS are not common under field conditions as they are heavy, expensive and not always robust enough, but there is no reason why you cannot make your own UPS from your separate battery chargers, batteries and an inverter.

4.3.3 Voltage regulators

If you are using the AC power form the city, then you may find that the voltage supplied varies a great deal from the quoted. In India or China, for example, a nominal 220V supply can often be 100V or less. Lights will brown out, tubes will fail to 'strike', so they will blink annoyingly, and your computers will go crazy. To solve that problem, you will have to use a Voltage Regulator, or

stabiliser. This consists of a kind of transformer plus control system which keeps the voltage to your vital equipment at least near to the nominal. (of course there are limits). However they are quite large and heavy, and also very expensive. Therefore you would only protect the most sensitive equipment this way. Some UPS's offer similar advantages. In fact you would only go to this trouble if you are intending a fairly long term operation which would prohibit the use of generators, otherwise your own generator is probably more reliable.

There are many excellent books and magazine articles on this subject but as it is rather deep, I will now change subject to the inevitable charging of the battery. For this we need a generator of some sort.

4.4 Generator Sets

If you intend using your equipment more than say half a dozen times, and if you do not have a vehicle available to charge from, then you need one of these. To be very correct, only the part that actually makes the electricity is the generator, the motor turning it is sometimes called the 'prime mover'. The proper name for both together is a 'Generator Set'.

Generators in turn can be Dynamos or Alternators.⁵⁸ Dynamos generate only DC and are not very common these days. Alternators generate AC usually at the voltage of 110 V AC or 220-240 V AC. It is common these days for there also to be a rectified 12V DC output from the generator for 'Charging Batteries'.

This means what it says, and while you can charge a battery from this output, you should not directly connect a DC device to this without a battery across it also. This is because the voltage has only been rectified and is too rough to be used by electronics and needs smoothing either by a battery, or a special smoothing circuit and voltage regulator.

Happily our Japanese friends have done a wonderful job in marketing very competitively priced portable petrol or diesel generators. Looking like knobbly red Jerry cans, they can be carried by their built in carry handle by one person quite easily. Honda, Yamaha and Kawasaki for example, have put a lot of effort into the portability, reliability and quietness of their products and buyers can shop with confidence for the best deal. Power ranges are usually from 100 Watts to 3000 Watts, which is quite adequate, but larger than this are not usually considered portable.

4.4.1 Rating

The main factor to consider when choosing a generator is it's Rating, this is usually quoted in watts, such as 1000W. This is the average continuous electrical power that it will supply without damage. In fact it is more brutal than that. The generator will have a circuit breaker or fuse on the generator output. This will trip or blow when the current is too high,(thus protecting the generator) so the peak load must be less than the rating of the circuit breakers.

As rating is what it really boils down to, there is no point in going to the salesman until you have a clear idea about how much power you will need.

The course of greatest wisdom is to add up all of the devices and chargers you intend to carry, add the lighting bulbs you may be using at night, and then multiply by at least 150%. The cheapest and best thing to do is purchase a single generator that is in the power output range above this figure.

4.4.2 Redundancy strategies

But there are alternative strategies. Buying only one generator is putting all your eggs in one basket, so it may also be good to buy two generators. This has the obvious advantage that you have a standby in case one generator fails. If you wish, you could buy two generators, both capable of carrying the whole load each, in which case you have a standby to hook up if the first one fails. This is called 'Cold Standby Redundancy' strategy, but has the disadvantage of wasting half of your money.

Alternatively, you may decide to have the load split up into two separate sections of load, with one generator supplying half of the lights and half of the coms equipment, and the other side the same so that the whole load is covered by two generators, each of a rating of half of the total load. This is called Load Splitting.

The advantage is that you have now purchased two cheaper generators, (but this is still more expensive than one large one). When the failure occurs, now only half of the systems need resetting. Wise juggling of the loads can bring the most important loads back on line but some loads will have to wait until the first generator is restored.

If you have two identical generators, and they both fail but for different reasons, then you have the option to cannibalise one of them to keep the other running, (if you have the right tools and the manual).

A popular and practical strategy is to have one generator and distribution system for 'Dirty loads' and one smaller one for 'Clean loads'. On the dirty system you could hook up battery chargers, devices with built in batteries, which will be protected from power outages by their own power, and all of the miles of spaghetti of wiring slung over trees and dragging on floors and getting kicked about carrying lighting to other sites. These are the ones most likely to fail, so we connect 'Don't Care' services to this generator.

We then have a separate, usually smaller generator for sensitive devices such as devices with no battery back-up, or especially computers (which HATE rough mains). This will be your 'Clean line' and you should guard what goes on it with jealous zeal. Then when one of the generators fails, you can haggle with the other team members as to which load is the most worthy cause to be restored while the other is being fixed. The whole issue of connecting consumers to a generator is much trickier than it looks. For generators of above about 3kVA, an electrician should supervise the installation.

Storing the two generators at separate locations and sending them out with different teams and on different vehicles also adds to security, as the chances of at least one getting through without being lost, damaged, delayed or stolen are greater. The very smallest generators can even be carried as hand luggage on a plane (but only with empty tanks)⁵⁹ and be subsequently carried by a person of moderate build if needed. No precaution is too much to make sure one of them arrives at the scene in tact.

4.4.3 Observing the Load

Remember the parable of the wise virgins in the Bible?(Matt 25:1-13). Many do not and so when they arrive on site with flat batteries, the happy humming from your generator will attract them from all directions.

Naturally this is fine, we are in the business of helping people, so it would be unbelievably possessive to refuse to let people hook up to your generator. However you do need to keep an eye on the total load, which will creep up slowly but surely as the operation goes on, until eventually your circuit breaker keeps popping off more frequently, leading you to think there is a fault on it. If this is happening to you, check all the hidden wiring right to the very end, in case someone sneaked an extra load on the line and didn't have time to tell you.

4.4.4 Frequency stability

These days it is rare to find devices that are sensitive to mains frequency. For example, in the days before quartz clocks, electric clocks were the most accurate. They worked by counting the cycles of the incoming mains. Obviously that will be no good when connected to a small generator with a varying load. As load goes up and down, generator speed will go up and down and so will frequency from the generator. Electric motors for example, will not stay at a stable speed. (Do you remember the music from record players at fairgrounds?). Today, quartz crystals are installed in most devices that are sensitive about timing, but if you have trouble with something that works perfectly well on the mains, try it on its own on a bigger generator to see if that works.

Generators are fitted with governors to keep the output frequency at least near to a nominal 50HZ, or 60HZ for 110V designs.. When there is little load on the generator, this could cause the generator to go too fast, so the governor detects this and throttles back on the fuel. The reverse is true when the load increases. The generator slows down and the governor responds by throttling up on the fuel to keep the frequency near to 50HZ. The manufacturer will specify the frequency stability of the generator in the specification book.

4.4.5 Don'ts

You may say, why not connect the two generators together in parallel and power everything from both of them, in a 'Full Parallel Redundancy' scheme This would mean that when a generator fails, there would be no loss of power at all.

Unfortunately it is not so simple as that. Remember that we are generating AC voltage here. This means that one generator could be making +240V while the other makes -240V. Result, BOOM! you have lost both of your generators. It is only possible to connect two generators if they are synchronised.

This in turn, is only possible if the generator is designed for this and in conjunction with special equipment called a synchroniser. Even then, synchronising generators has to be done by someone who has been shown what to do as it is quite tricky. I have never seen synchronisation available on a portable generator of the type we are likely to use, so..

NEVER CONNECT TWO GENERATORS TOGETHER.

NEVER CONNECT A GENERATOR TO THE MAINS.

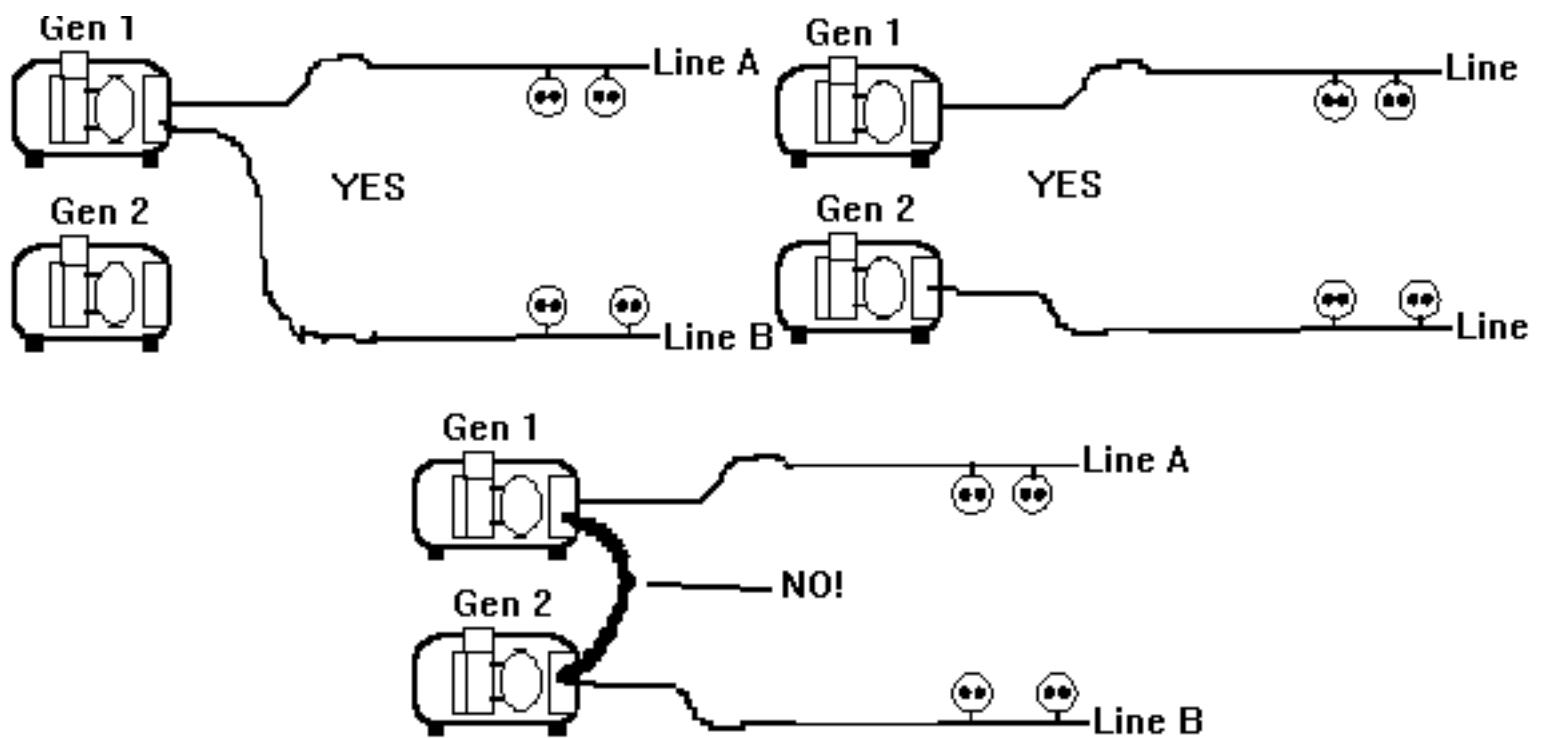


Fig 15 In case of gen failure, or to save fuel when loads are light, one genny can be connected to both lines but two gennys must never be connected together

Interlock box, built such that it is only possible for two switches at a time to be closed

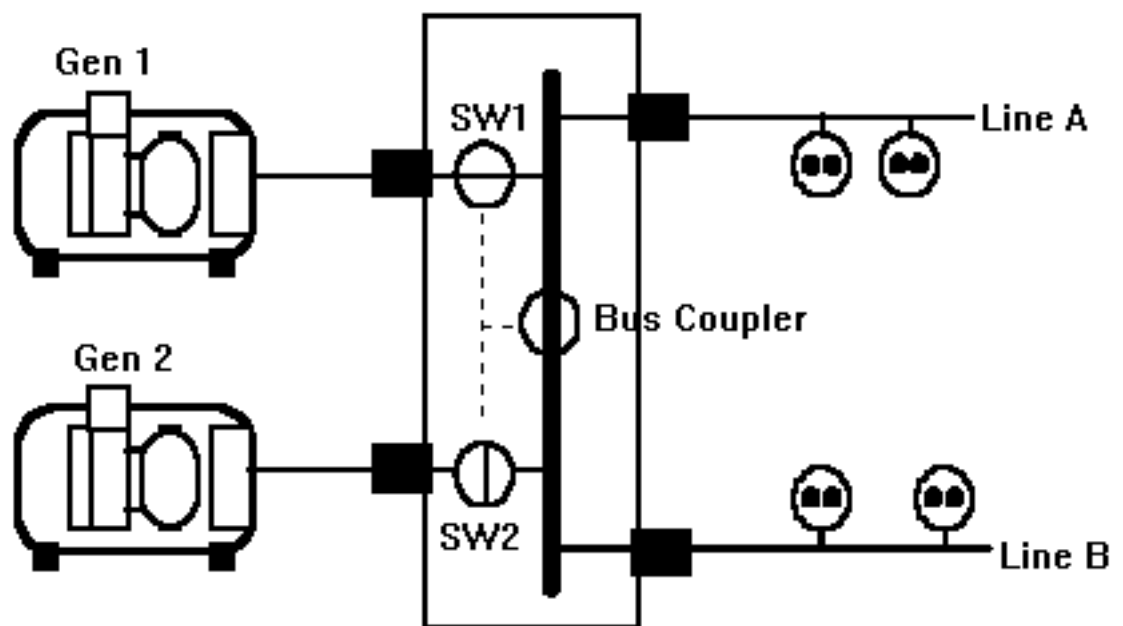


FIG16 A more professional method for a permanent installation is to use a special interlock box interlock box making a mistake impossible..

The only reliable solution is an Interlock.⁶⁰ This is a box in which the switches are mechanically coupled together in such a way that only two switches at a time can be closed. In another design, each switch needs a copy of the same key before it can be closed. The key is then captured in the switch until the switch is opened. However we arrange that there are only two keys available, thus making sure that three at a time can not be closed.

4.4.6 Fuel

As sure as your battery will need charging up in about one day, your generator will need re-fueling usually in one day. The portable generators usually on sale these days have a 'service' tank built in to them which will sustain them for about 8-16 hours of continuous use at full output.

As the governor will decide how much fuel is used, it is rather hard to guess exactly when fuel will run out. If you just wait for the generator set to stop, then look for fuel in the dark, you can expect hours of trouble bleeding the air out of the system. A better move is to take a dip stick reading of the service tank every hour or so and top it up when convenient. This is easier if the tank is fitted with a fuel gauge of course, but in any case it is wise to record in a log book, how much fuel is used, so that you can estimate how much fuel to find for each day's work.

Modern generators come in a choice of petrol or diesel models, four stroke or two stroke. Finding the fuel you may need locally could be a problem and you will become more desperate as the days wear on. Even when you find a supply of fuel, your frustrations will not end there.

The possessor of the fuel knows that he is in a strong position, and will want either hard cash in US dollars, or barter for something he can't buy at any price locally. So you may need the cunning of a camel haggler and connections of sergeant Bilko to get what you want. It is a good idea to get a few goodies from the duty free shop at the airport to barter from a strong position. The smart move is not to let this happen to you, and always arrange your own supply of fuel.

4.4.7 Diesel

Diesel models have the advantage that you can probably find diesel almost anywhere, it can be syphoned out of a truck for example. Most large vehicles are diesel powered and have very large tanks, so you have a large and ready supply if such vehicles are around or if they regularly pass through an area, in which case works areas may have many barrels of it somewhere, (ask very nicely).

Failing that, you can carry some around in Jerry cans with you. Diesel is quite safe to store, so few places will refuse to transport or store it in metal cans.⁶¹

Diesels do not have an ignition system (spark plugs), so this makes them less prone to failure than the more complicated petrol engine. Diesels are famously reliable (once you get them started) and are unlikely to pose any kind of fire or explosion hazard. However it is rare to find a Diesel generator set rated below 3kVA

4.4.8 Petrol (gasoline, Benzine)

Petrol models have the advantage of being cheaper and lighter than their diesel counterparts, which is important for portable equipment. As they have ignition systems, this is potentially a source of problems so they are marginally less reliable than diesel.

The problem may be transporting the fuel. **It is forbidden to transport petrol on an aircraft** so you will arrive at the operation with empty tanks. (not usually such a big problem with diesel which has less dangerous fumes, although you must seek permission first).

You must therefore go and look for petrol when you land and before you need your generator, (if you have the time). Don't allow yourself to be hustled into the back of a truck and rushed off, until you have filled your service tank and as many cans as possible.

If there are plenty of cars and mopeds in the area of operation, then finding petrol should not be a problem, but the manufacturers manual should be checked to see what grade of fuel is required.

Two stroke engines have the additional problem that the fuel needs be mixed with oil. Again if there are plenty of mopeds in the area, then a source of mixed fuel will be available. If not you will need to bring or find the correct oil, and remember to add it in the right proportion yourself when fuelling the generator.

4.4.9 Cleanliness

It may not be easy to keep the generator area clean, but if the area gets dusty or sandy, then there is a high chance of getting sand or dust in the fuel. This will block the fuel lines and very tiny jets in the carburetter of a petrol motor, so careful filtering of all fuel going into the service tank is a must. Pour it through a clean cloth if in doubt.

4.4.10 Siting

Generators are anti-social, noisy,⁶² and smelly. No-one wants to have to sleep next to one. Working near them gives you a headache from the noise and fumes, and makes trying to read, write or rest very demanding. Worst of all, the noise will make telephone calls difficult for the persons at both ends, and increase the likelihood that a radio call will be missed even if the radio volume is at its maximum (which it will have to be, giving a distorted barking sound sure to stress the operator).

The proper thing to do is designate a generator area, in common with the other groups in the same camp. This should be behind something to baffle the sound, such as a wall. Failing that, try to use a lorry or build a sound baffle from bricks, stones, wood or anything else around.

Do not totally enclose the generator or mount in an inside room. It will choke on its own exhaust fumes, and also overheat and become damaged. So it needs to be somewhere well ventilated.

Security can then be a headache as now you cannot see who is near it at all times. So the eventual site will be a compromise between perceived operator fatigue and security.

Of course if you are running the generator for a short time only, then none of those problems are serious enough to add complications, and you can just place the generator near to the device.

4.5.1 Distribution

A further problem is Distribution. You will need a long enough wire to reach from the generator to the place where the power is needed, about 50-100m away.

In fact, once a generator is running, and dark sets in, many places will be found where power is needed, for lighting among other things. So you may need enough wires to get power to half a dozen tents.

We have already mentioned the dangers of overloading the generator but as the only result of doing this is to trip the circuit breaker and thus shut off all of the power, so there is little danger of an overload fire.

A wise precaution is to install an Earth Leakage breaker(ELCB), or Residual Current Breaker (RCB) in the line also (if not already fitted to the 'genny') to protect you from electric shock . If recommended by the manufacturer, a protection earth can be installed with a ground spike which should be driven in with a heavy hammer.

There may be many hazards associated with the distribution as everything is done in a hurry so wires are left on the ground where they can trip people up and also become snagged on vehicles which then drag the whole camp down, rattling expensive electronics along the ground with it.

Slinging wiring overhead can be just as bad, because passing higher-than-expected vehicles can drag the cables down as well.

At places where one wire joins another or another line is teed off. there will be a multi way plug and socket arrangement. It is important to keep them free from mechanical damage and water, so a quiet corner in a tent is usually best.

The distribution cables are quite heavy things, counting the plugs and sockets, so a reasonable balance needs be struck between perceived need and cost, size, weight. Carrying two or three reel-in extension leads is usually sufficient and cheap, but extension reels must be **fully unwound** when in use, or heat could build up in the reels and cause a fire. In some cases several small generator sets may be better than one large one.

4.6 Other Auxiliaries

You should also carry enough tools, such as wire cutters, screwdrivers and knives to make and splice cables as required. You should also carry spares, such as spark plugs, mains plugs and sockets etc.

It may also become necessary to think of adapter kits for powering devices with strange plugs.

You will need to find out how many different types of fuse are present in all the devices and power supply systems you have. It is wise to carry at least 2 to 5 of each.

Take a voltmeter capable of measuring AC Volts up to 500V and resistance. An audible continuity 'beeper' is also very helpful. Always check a suspect power source before plugging in your precious devices, by testing it with your voltmeter.

4.6.1 Transformers

Devices with American plugs will usually need 110V and should never be connected to a 220V generator or both will be damaged. There is often a hidden control inside or round the back of the device to change the voltage but if you have any 110V devices without voltage 'tappings' you will need a Transformer to convert 240V to 110V. Try to do without this though as transformers are very heavy and expensive.

4.7 Alternative energy

If you think that fuel is going to be a real problem, or there are environmental or economic considerations, then you have two other options.

- Wind power
- Solar power

Of course there are others too, but as we are talking about disaster and aid communications, let's keep to solutions that can be put up immediately.

There are shelves of better books than this one about just this subject alone, so I propose only to highlight the points important to disaster Communication. For a more full consideration, consult the book "Where there is no Telephone", (see Bibliography)

4.7.1 Wind Turbines

These are a great favourite with yachtsmen who spend a lot of time in quiet harbours. They need power for radios and lights, but will be 'black balled' if they make noise with their generator or run their stinky main engine. The Wind Turbine generator set is very quiet, and runs for years with hardly any attention required. They can be purchased ready made at reasonable prices.

Of course they will not generate any power if there is not enough wind. This means that you cannot afford to power the radios direct from the wind turbine. You can bet that you would need to make that call when there is not enough wind.

It is more sensible to think of them as battery chargers, charging up batteries off line, batteries which are then used to power the radios as required. Therefore, they are more suited to aid applications, which do not require 24hr operation, but will be making a call to base say once every evening.

This approach also means that a lower rating of turbine is needed, making for a smaller, lighter, easier to carry turbine. A further point is that they continue to do their stuff by night as well as by day (if there is wind), so a convenient overnight charge is possible.

The turbine needs to be sited where it will catch the wind, and atop a pole at least head height, the erection of which is a tricky job for at least 4 people, taking about 1 hour.

4.7.2 Solar Panels

If you think that the wind may not be reliable enough, then think of solar panels. These can be purchased from any good yachting chandlers and many models fold down into compact portable units. Some radio manufacturers even sell a suitable kit of solar panels and their control circuits to suit a particular model of radio. This is another subject covered very well in the book, 'Where There Is No Telephone', but here are some important points.

Panels have very low ratings however, and so while it is possible to power devices directly from them, it is not practical. Therefore, these too should be treated as battery chargers.

Three problems. They are less effective in northern cloudy countries in the winter. They are easily damaged and so should be cared for well. They work only during the day, so a convenient overnight charge is not possible.

As with the Wind turbine, I feel that it is best suited to aid applications rather than disaster Relief applications.

4.8 Summary

So all you wanted was a telephone, but now you are up to your neck in Power Supplies and the money is flying out of your pocket. But do not despair. As I said at the start of this section, if you think small at the start, and budget power wisely, you can provide affordable and reliable power. Make sure you or someone in high authority in your organisation is designating someone to keep an eye on the devices, their batteries and their power needs and being well prepared for the eventual day when it will be put to the test. Whenever thinking of a more elaborate communications system, you should think of the power implications also.

⁵⁴IATA regulations restrict the air transport of most types of batteries.

⁵⁵The only reliable method of knowing battery charge is to use a Hydrometer. Looking like syringes with a rubber bulb at one end, they suck a sample of battery acid up into a sight glass where a calibrated float will read off the electrolyte density.

⁵⁶But not necessarily, some experts say that gel type lead acid batteries are better and easier to charge.

⁵⁷Many modern portable devices have voltage regulators built-in, but if they don't the regulator will help protect the device against damage from overvoltage spikes and reduce risk of interference from one device to the other down the power cable.

⁵⁸There are others but they are out of the scope of this consideration.

⁵⁹and officially no engine oil either.

⁶⁰Or a 'fool proof' plug system if loads are light.

⁶¹Diesel can be carried in aircraft but you must ask permission.

⁶²Units rated below 250W are often very quiet.

CHAPTER 5

5 Legal Issues

5.1 Introduction

=REPORT=REPORT=

An outbreak of the plague in Siberia. A British medical team is rushed to the scene to help and bring supplies. One of their tasks, to report on stocks of supplies in order to have more sent out if needed. A kit of INMARSAT-C gear is borrowed from DRCF and rushed to the team to make the deadline for departure. At the airport on arrival in Siberia their equipment is confiscated! why? Because they do not have a licence for the equipment.

WARNING

I must warn you that under normal conditions, technically speaking, what you are about to do, bringing communications equipment into a country without proper documentation is absolutely

ILLEGAL!

There is no way around this (at the moment), that is the situation and all of the old hands know it well. Don't be tempted to push anyone around or shout the odds with officials, they can slam the door in your face very firmly if they think you are a trouble maker. For goodness sake don't risk losing any friends at the first hurdle (unfortunately you will have plenty of battles to fight) **don't let your adrenalin drive your tongue** or everyone will soon find out what a inexperienced fool you are

and treat you accordingly.

Keep calm.. read this...

Now I know that many in our business are frustrated and resort to bureaucrat bashing, but this is a mistake and we don't indulge in it. It is the duty of civil servants of any nation to enforce and administer the international laws on radiocommunication and quite rightly so. They are often keen to do all they can when they see an obvious exception to the rules, but sometimes we must do our part to help them to do this without putting themselves into serious trouble, for their powers are limited.

If there were no rules, radiocommunications as we know it would be impossible. Try using a CB set in central London or Birmingham and you will see that anarchy doesn't work well by radio. The radio spectrum is a finite and very precious thing. For example consider a satellite up link channel. If just any one were allowed to operate a transmitter on these frequencies, this would jam the satellite and make it unusable by you or anyone else.

The tragedy is that it may be the jammer would have no idea of the problem he is causing and even worse, if he is aware and is not of a mind to co-operate, there is hardly anything you could do about it. The problem is the same for HF radio. a person using a frequency with very high power can completely block other users and not be aware, or not care.

You can see why earnest international effort goes into deciding on international spectrum usage plans, and the most zealous guarding of the spectrum from those who would operate outside of the plan ,called Pirates, of which there are sadly all too many.⁶³

Each nation is responsible for making sure that the Internationally agreed rules are applied in their territory. There are many rules and regulations covering not only what can be done but also who is allowed to have the privilege of operating equipment which can potentially embarrass the host nation far beyond its own borders. This is why Radio Officers and Radio Hams have to pass such rigorous examinations before being allowed such freedoms.

The same is true for the equipment. Badly made equipment or obsolete types can ruin the whole game for more conscientious users and so only 'Type approved' equipment is allowed to be used, guaranteeing compatibility with existing or future services.

The seemingly obstructive bureaucrats perform for our benefit this very important service, they deserve our respect and support but are usually badly misunderstood by understandably pressured and frustrated disaster workers who need vital equipment and need it NOW.⁶⁴ They want to help us and are actively looking for ways around regulations that were intended to facilitate international co-operation not hinder it.

The whole business is very delicate indeed and needs handling in a mature and utterly responsible way. Work is always in progress on this subject and so the situation is always changing from country to country and even day to day. What follows is what I hope is a useful overview of the problems and solution faced by disaster communicators.

First, let us introduce the players in our drama.

5.2 The ITU

The International Telecommunications Union (ITU) is an international organisation, based in Geneva. Its main job is to make international telecommunications possible by setting standards. 'Working groups' of experts on a particular question or technology produce declarations stating what in their opinion is the best way of standardising communications. For example they decide how much and what frequencies are designated to each service who would use the radio spectrum. They also set standards in signalling so that a computer in one country can talk to one on another country and thus set up long distance telephone calls.

Periodically there are conferences where nations send a representative of their telecommunications organisation or ministry, in order to sign such agreement. However no country is obliged by law to keep to the resolutions, they do so because everyone agrees that it is in the best interest of international communications to standardise some things.

5.3 WGET

The Working Group on Emergency Telecommunications (WGET) is a group of experts in disaster communications. They meet regularly in order to make recommendations to be included in 'The International Convention on Emergency Telecommunications' to be held in the first half of 1996. They are subdivided into two groups:-

Group A is responsible for legal and regulatory issues to do with the definition of the format and structure of the forthcoming convention on emergency telecommunications. The facilitator of this group is the UNDHA.

Group B are responsible for Operations and system aspects of emergency telecommunications. This is the more technical stuff. Their job is to review what technology there is, what there will be, how it is used now and how it ought to be used in the future. the facilitators of this are the Committee International of the Red Cross (CIRC), and the Swiss Disaster Relief organisation (SDR).

5.4 UNDHA, DMT and UNDAC

To define the role of the United Nations Department of Humanitarian Affairs (UNDHA), also known as DHA, I could do no better than to quote a speech at the opening of the WGET's first meeting, made by the Director of the DHA himself, Martin Griffiths.

He says, - *"The mandate of the DHA... includes...the collection and dissemination of information related to humanitarian emergencies, the mobilization, co-ordination and facilitation of international response to natural and man-made disasters and the provision of support to national and regional efforts towards disaster mitigation preparedness and prevention."* He goes on to make the important statement. *"Non of these tasks can be accomplished without the extensive use of telecommunications."*

To provide on the spot practical help, the United Nations Disaster Assessment and Co-ordination team (UNDAC) is a team of experts in various disaster management related fields. They can be ready to give advice, and help with the co-ordination of international relief teams.

Apart from a permanent communications system within the UN, UNDHA has also developed a concept for disaster communications. The On Site Operations Co-ordination Center (OSOCC), is a field unit, flown out by the operators as hand baggage, and situated at or near to the disaster site. It is equipped with Satellite, VHF and HF Radio for communicating with local rescue teams and authorities. and is manned round the clock by expert communicators. It then uses these facilities to

pass information to and from another unit in the capital of the affected country. When not in use the equipment is stored in Geneva.

The Disaster Management Team (DMT) is an ad-hoc group formed in the capital of a country affected by a disaster and consists of the representatives of all UN agencies and other major partners in humanitarian relief based in the capital. It is normally convened and chaired by the Resident representative of the United Nations Development Programme (UNDP) in his function as Resident Co-Ordinator of the UN System. The DMT is the main link to the national government of the affected country and to the Headquarters of the agencies concerned.

5.5 NGO's

The Non-Governmental Organisations (NGOs) are usually charities, not funded by any government, but by voluntary contributions from the public. For example the Red Cross and the DRCF are both NGO's, but of very different size! The Royal Signals Regiment of the British Army, for instance, is obviously not an NGO. The fact that NGO's are not funded by governments is both their strength and weakness. On the one hand they do not pose a political problem to the host government where the disaster has occurred. On the other hand they are often very small and poorly sponsored. Communicating with NGOs is sometimes difficult because the important figures of these organisations are often private individuals operating from their own homes. Some have pagers and callout systems but some do not.

Now that the stage is set, let's see the action.

5.6 Tampere Declaration, 1991

You should obtain your own copy of this very important work directly from the ITU. (see appendix) However, it is so important that I am now going to paraphrase it, adding my own comments. *The paraphrased sections will be in italics*, my comments in normal text.

The Tampere declaration on disaster communications, 22 May 1991, Tampere Finland, was the result of the considerations of a 'group of experts in communications and disaster management'.

After the acknowledgement that each country has responsibility for disaster communications in its own territory, the group went on to look into early warning systems by satellite, and methods of quickly disseminating the information, by for example the use of broadcasting.

Paragraph 7 recognises that *communication links are almost always disabled and disrupted during the first few hours of a major disaster, whereas there is an urgent need to establish comprehensive communications.*

The Tampere conference called for *a convention on disaster communications to be developed not later than 1993.* (This has not yet happened at the time of writing, in 1996 but is expected in 1996). *The proposed convention should produce a comprehensive accord on disaster management.*

Interestingly, the conference recognises *the needs both of short term disaster relief organisations, and long-term needs of disaster mitigation.*

Under the heading ' Communications in disaster relief', para 11 recognises at least four present

limitations to disaster communications. Organisational barriers which impede the flow of information, uncertainty over what equipment is available and where, regulatory barriers both radio and importation, and rather refreshingly, the high cost of the most effective equipment (such as satellite), which inhibit their use by hard-up NGO's.

Tampere urged that the proposed convention on disaster communications should at minimum, set up a framework for all organisations to work together in a more co-ordinated way. The convention should also make sure that existing networks are utilised to the maximum.

Significantly, the convention should encourage the development of the Amateur Radio Services and their application to disaster communications.

A further recommendation was that all organisations should disclose the whereabouts and availability of their equipment so that a central database could be established detailing what is available and where.

Tampere also encouraged improved and enhanced national and international training programmes to develop the necessary expertise in the rapidly evolving field of disaster communications and the further consideration of the communications issues in disaster management training programmes.

Paragraph 12 subsections G, H and I are of very great interest to us. G urges the proposed conference to facilitate the rapid dissemination and effective use of communication equipment and resources by limiting, reducing and, where possible, removing regulatory barriers such as customs duties, restrictions on possession, technical information and rules concerning the temporary assignment of appropriate radio frequencies.

Subsection H urges the establishment of rules relating to entry exit and transit of men and equipment and other privileges. This is not under ITU responsibility and the UN is dealing with it separately. It is a matter of customs facilitation for relief equipment in general.

Section I urges the establishment of the basis for an appropriate tariff structure for domestic and international communications carriers including waiver of charge where appropriate and the necessary philosophy and approach to payment for communications services required in disaster relief efforts. WGET is working on this with the individual operators.

Paragraph 18 again recommends the development of a proposed convention on disaster communications to be co-ordinated by UNDRRO (now the UNDHA) in co-operation with the ITU.

Para 19 is another one of interest to us. It recognises that it may take time for development of such a conference so the Tampere conference called upon all states to consider urgent measures to give effect to the provisions of this declaration on an interim unilateral or bilateral basis for general humanitarian reasons. This conference is now scheduled for first half of 1996.

Remembering that the conference has no actual power, why is this so important?⁶⁵ Well the rules that actually apply depend not upon the august bodies of international law, but rather on the administration of the state who's sovereign territory you are in. In fact they can give the nod or turn the blind eye as they will. What is stopping them from doing this? Perhaps the official you meet thinks he does not have the authority to do so. In which case, showing this may give him a graceful way out of his dilemma if he wants it.

However the conference needed recognising by a higher body, and this happened at the ITU World Telecommunications Development Conference, Buenos Aires march 1994, which we will discuss

next

5.7 ITU Buenos Aires 1994

The ITU World Telecommunications Development Conference Buenos Aires march 1994 has useful information for us in Resolution 7 'Disaster Communications', which was unanimously adopted.

The ITU notes the Tampere declaration and further notes several other sources all agreeing heartily with Tampere. ITU recognises that disasters are bad and is convinced that telecommunications are good, but is concerned that they will not be working when needed.

They resolve to study the problem further, and include in the agenda of a competent World Radiocommunications Conference the relevant provisions, in other words, to make it happen. Interestingly for us, the ITU is invited to study charging and accounting in domestic and international disaster communications including waiver of charges where appropriate and a suitable tariff structure.

The best immediate paragraph is that the ITU urges administrations to take all practicable steps for facilitation the rapid deployment and the effective use of telecommunication equipment for disaster relief by reducing and where possible removing regulation barriers and strengthening transboundary co-operation between states. Again, this is something you can invoke if you find that an official is confused as to whether he has the right or authority to 'turn a blind eye' to what you are doing. If he can say that you have invoked this, perhaps he will feel less exposed.

5.8 ITU Plenipotentiary Conference, Kyoto 1994

The Final Acts of the Plenipotentiary Conference Kyoto, 1994 in its resolution 36, headed 'Telecommunications for Disaster Mitigation and Disaster Relief Operations' endorsed resolution 7 of the World Telecommunications Development Conference Buenos Aires 1994 and instructs the secretary general to report to the council at its 1995 session on the measures taken pursuant to WTDC resolution 7.

ITU ends by directly quoting resolution 7 urging administrations to reduce or remove barriers etc. Here is the **so far most powerful argument** you can use to persuade sluggish officials of your credentials.

5.9 ITU Resolution 640

An important Resolution affecting Amateur Radio operations is Resolution 640 of the International Telecommunications Union (ITU)World Administrative Radio Conference (WARC), Geneva, 1979. Its proper title is, "Resolution No. 640, Relating to the international use of Radiocommunications in the event of natural disaster, in frequency bands allocated to the Amateur Service".

It is readily available as part of the ITU Radio Regulations edition of 1990 revised 1994, directly from the ITU.

The ITU considers that in the event of a natural disaster, normal communication systems, such as the 'phone system, TELEX, mobile phones etc. are frequently badly damaged by the disaster, for example by destruction of the telephone exchanges (on which so much depends), or the mains electricity (which powers electronic communications systems). Even if this is not so, then the system may become overloaded. This will happen because in a normal situation, much less than 5% of the users of

a certain telephone exchange will normally be using it at the same time. Therefore the exchange, for reasons of economy, only has enough circuits to carry about 5% of the theoretical maximum calls. As not everyone making a call will be calling outside their town, there are only about 10% of the lines leaving a town as there are circuits provided in the exchange.

Now visualise the situation when every user tried to use the phone at the same time. Only 5% will get through. This situation is called Blocking, or overload. The situation is the same or worse for the mobile phone system, so you can see that you can't depend on the normally dependable phone system in a disaster.

Against this, *rapid establishment of communication is essential to facilitate world-wide relief actions.* As we shall see, arranging communications by radio is hardly rapid, it can take weeks to get the licences, frequencies, type approvals etc.

On the other hand, *the Amateur bands are not bound by international plans or notification procedures, and are therefore well adapted for short term use in emergency cases.* ITU considers that *international disaster communications would be facilitated by temporary use of certain frequency bands allocated to the amateur service. Under those circumstances the stations of the Amateur service, because of their widespread distribution and their demonstrated capacity in such cases can assist in meeting essential communications needs. In fact there exists national and regional Amateur emergency networks using frequencies throughout the bands allocated to the Amateur service.*

ITU considers that , *in the event of a natural disaster, direct communication between Amateur stations and other stations might enable vital communications to be carried out until normal communications are restored.* The significance of this is that normally, a radio Amateur would refuse to talk to a non Amateur station because his licence prohibits this by law. Amateurs know the law because one of the two theory papers he must sit to get his licence is on radio law. By this resolution, the Amateur is allowed to work you and traffic messages for you and from you, this is called 'Third Party Traffic'. However he may need reassuring of this because all of his transmissions must be entered into a log book, which will be inspected by a government official. Therefore you should state clearly that you are invoking Resolution 640 for the traffic, this should put his mind at rest. **It is however assumed that you do have some or other licence from the host government for the Radio equipment you are using.**

ITU is pragmatic enough to realise that *The rights and responsibilities for communications in the event of a natural disaster rest with the administrations involved.* This means that you should get permission from someone to use resolution 640 on their territory.

On the other hand, if no government exists, then they are hardly likely to send radio inspectors around to check you equipment, so in that case you can probably safely go ahead until such authority appears. The subject of 'Spectrum use in a political vacuum' is on the agenda for future conferences, but in the mean time, what you get away with depends upon how mature you are about your privileges.

ITU resolved that *the bands allocated to the Amateur service which are specified in Radio Resolution 510 may be used by administrations to meet the needs of international disaster communications.* Note that it is the government that has this permission not you. You don't have an absolute right to demand these privileges from the government, so you must use diplomatic language when urging them to get on with giving some kind of 'nod'.

The Resolution also states that *such use of the bands shall be only for communications in relation to relief operations in connection with natural disaster.* In theory this means that you can't invoke it in a war zone, but in practice that will depend as usual on the administration (or lack of it).

The Resolution goes further to state that the use of specified bands allocated to the Amateur service by non-Amateur stations for disaster communications, shall be limited to the duration of the emergency and to the specific geographical areas as defined by the responsible authority of the affected country. This seems obvious and fair. The amateur bands are highly overloaded normally, and so can't handle unnecessary traffic that could or should go by 'phone once the normal services are restored. Don't use it to save money, only if it is the only alternative.

ITU state that disaster communications shall take place within the disaster area and between the disaster area and the permanent headquarters of the organisation providing relief. This means that you can contact Amateurs in for example the UK, and ask them to relay messages to your HQ. You can even set up a station in your HQ if you can find an Amateur to operate it. Again, a reminder that such communication shall be carried out only with the consent of the administration of the county in which the disaster occurred. And that of the country where your HQ is situated.

There may already be existing networks of Amateurs to traffic information out of the disaster area, and they will be using up much of the spectrum for this. For you to duplicate this effort is very wasteful of your resources and spectrum so the Resolution makes the proviso that relief communication provided from outside the country in which the disaster has occurred shall not replace existing national or international Amateur emergency networks. The point is also made that close co-operation is desirable between Amateur stations and stations of other radio services which may find it necessary to use Amateur frequencies in disaster communications.

We disaster Relief service users may feel that we have righteousness on our side and that we should have right of way, but not so. Para 8 states 'that such international relief communications shall avoid, as far as possible interference to the amateur service networks'. Therefore you have no right to demand that another station gets off your channel. You could though ask him to move off explaining the reason by saying "QRT (stop sending) or QSY (change frequency), we are a disaster Relief service working to Resolution 640", (which he should have heard of).

ITU then concludes by inviting administrations to provide for the needs of international disaster communications and provide for the needs of emergency communications within their national regulations. In the UK the Radiocommunications Agency (RA) does this by encouraging radio Amateurs to set up and practice emergency networks.

5.10 Reservations

Note that all of this assumes that you have got some sort of licence already valid in the host country. This means that foreign rescue teams do not automatically benefit from Resolution 640.

There is very much to be gained by the use of Amateur Radio by disaster relief organisations. It solves the problem of Type approval (as there isn't any), frequency allocation, as the frequencies are already allocated and inter working with other groups.

However it must be only a first fix. Resolution 640 is strictly for the acute phase of the emergency, about the first 4 weeks. If the operation is intended to for say longer than 4 weeks, then the usual procedures should be used to become properly established with a permanent licence. Inter working is often a problem as you may not be allocated the same frequency as another group you need to work with, and may not even know their frequency.

Using the Amateur bands is part of the solution during the acute phase, the other part is to agree to common calling channels, which everyone listens to, once a frequency allocation has been set by the host country. This requires you to remember to move to a separate working frequency (if one has been allocated) when you have the person you need, otherwise congestion could occur.

Obtain your own copy of the resolution and take it with you. You may come across an official who is reluctant to allow your equipment in to his country. Showing the Resolution and explaining it should demonstrate to him his obligation to be 'helpful', but remember, he is still the boss so ask, don't demand.

5.11 Comments

If you have an Amateur radio licence valid in the host country into which you are bringing your equipment and are mature about it, you can overcome the problems of licensing and type approval by bringing in Amateur band equipment and operating under Resolution 640. Once in the country, you could use Amateur Bands for local station to station communications, and if you take a general coverage transceiver, you could also use commercial frequencies, such as those of Portishead radio's for international traffic, provided that you have a licence so to do.

=REPORT=REPORT=

During the Koybe, Japan earthquake disaster, local radio hams provided 200 VHF handsets and quickly established many repeaters in the disaster zone.-RSGB

There are Amateur frequencies advertised as for disaster traffic in the VHF bands, so you could use amateur handheld equipment to communicate locally. Some models of modern Amateur equipment are however, rather complicated to operate, so you would need to be careful about what equipment you bring.

You should of course only use these privileges if you are intending a temporary stay in a disaster zone. You cannot use amateur band in a non-affected area, so you should start to apply for permanent channels if you think you are in for a long haul. To preserve inter working, co-ordinate this with other groups so that you will still have at least one common frequency.

At the end of the day, you will get what the host government allows you to have. None of the Resolutions give you any kind of direct right to use anything at all on someone else's sovereign territory if they say no. If you come across someone determined not to help, your only hope is to escalate the matter to someone higher until you get joy.

When you get someone who wants to be helpful, they may feel nervous about how much they can turn a blind eye to without getting into deep hot water. This is where your copies of the Resolutions endorsing Tampere come in (so remember to obtain copies and carry them about with the documentation for the equipment).

Don't refer to the recommendations as 'your rights', this will blow your credibility, rather you are 'requesting privileges'.

Be persistent but pleasant, use the word 'urgent' a lot, keep showing and reading the resolutions, and don't be afraid to escalate to higher authority when you get stuck. Good luck!

5.12 Slow Track

The provisions mentioned in Resolutions 640, 7, and 14 are only meant for temporary use while the proper authority is sought. You should at once start the procedures for applying for permanent use of the equipment if you expect to be there longer than say 4 weeks.

Some of the procedures are different for INMARSAT equipment, so you should ask for advice from INMARSAT.

To give you an idea of what you are up against, these are some of the things you will need to do to operate a permanent HF radio network.

5.13 Licences and frequency allocations

You must obtain a **Licence** to operate a radio transmitter, usually from the Post and Telecommunications administration of the country you are working in. Then you will need a **frequency allocation** from the host government also. Part of the clearance you get may be needed from the national security services, so make sure you don't even purchase and import the equipment until you have the licence. There is more information about this in the book "Where There Is No Telephone" but here is a summary.

First conduct your own survey of what you need, and what frequencies you think will be the most effective. You will need maps, diagrams and estimates of the expected traffic. Then go to the dealer of the intended equipment for performance specifications. Now you are ready to do battle.

This process can be a bureaucratic nightmare. You may be asked to show maps and diagrams of the network you intend to construct, give great technical details about the performance of the equipment you intend to import, even down to circuit diagram level, and provide detailed information about the nearest telephone system, in order to justify your frequency allocation.

The authorities may specify what equipment you shall use, with what power, what frequency and at what time of day. So it is a good idea to find out what other equipment is being used in the area in order to find out what sort of thing is acceptable.

You may have to be very persistent because some authorities will not grant a licence because they are intending to install telephone service in the area, (but they don't know when). Or they may just have a policy only to grant 1 out of 10 applications they get. The problem is that they may not inform you that your application has stalled, it is your business to hassle and haggle until you get what you need.

Sometimes the government prefers to work with a single voluntary body or consultant firm rather than any individual. Try asking around for who seems to have the most success.

5.14 Licence fee

Licence fees are renewable annually. The amount varies, but is around 100USD per set per year.

5.15 Type Approval

When you ask your salesman, 'does this have type approval?' he will say 'yes'. Of course it does or they would never sell any. A better question is 'is it type approved in the country where it will be used, for this purpose as defined in my licence conditions?'. The rules for type approval vary according to

time, country, and use. It is not the dealers responsibility to know that, so you should show him your licence as a spec for the equipment. Get a second opinion also, there are lots of bad stories about this.

5.16 Import Licences

You will be viewed as an importer if you bring equipment in to the country. Therefore you may be required to pay import taxes on it. You should find out about all this long before the stuff is shipped out and make sure the paperwork is along with the equipment, to prevent delays in customs. There are provisions occasionally for aid agencies not to pay import charges, if so, the relevant paperwork must be prepared. If the equipment is a gift from another organisation, then proof of this is also needed. The UNDHA is actively working of improving this situation.

5.17 TIR

If you are intending a short stay, then a TIR carnet will enable you to bring the equipment into the country without paying any dues. However you must remember to take it out of the country when you say you are going to, or else you will have to forfeit the bond that you put up to guarantee this. Even if it is destroyed, scrape up the bits and re-export them or you will lose your bond. One problem is that not all countries offer TIR service.

5.18 Pro-forma Invoice

At the customs officer's discretion, he may decide to allow you to import the equipment as 'personal', provided that you and only you re-export the equipment. A ticket is added to your immigration card and added into your passport, stating that you cannot leave without the equipment in your possession. You need to help customs by providing realistic estimates of the value of the equipment, by a document called a **pro-forma invoice**. This states the purchased or current value of the equipment. It goes without saying that you must fly out with the equipment that is mentioned in you passport or you will suffer delays and even heavy fines and penalties.

5.19 Draft of 'Disaster Telecoms' convention

At the time of publishing this edition of the book, the draft of the future convention was taking shape. Likely by the time you read this it will look different from this early draft, but I hope that its general shape will give you an idea of what the other work has been leading up to. This time, my comments are in italics and the text is in normal text. By the way, the drafters of the convention have very kindly checked over my comments and agreed that they are within the spirit of the convention.

If you have the hard bound version of the book then you will find the whole text in the appendix. I will now give a simplified commentary on some of its parts that caught my eye. It is not enough just to read my simplified commentary in order to understand its provisions. You can read it yourself and see what catches your eye. For an electronic copy, try, <http://www.law.indiana.edu/law/disaster/disconv4.html>

**CONVENTION ON THE PROVISION OF TELECOMMUNICATION RESOURCES FOR
DISASTER**

MITIGATION AND RELIEF OPERATIONS

Drafter's Note

Telecommunication resources are increasingly recognized as essential to preventing, predicting, preparing for, responding to, and providing relief during and following disasters and other humanitarian emergencies, irrespective of their cause or duration. The effective use of such resources has been repeatedly demonstrated to reduce loss of life, human suffering, and damage to property and the environment otherwise caused by disasters. Moreover, telecommunications plays a central role in all humanitarian relief and assistance operations, especially those requiring international coordination.

Recognizing the critical importance of telecommunication resources in disaster mitigation and relief operations, representatives of States, United Nations entities, inter-governmental and non-governmental organizations, humanitarian agencies, and many other communication- and disaster-related organizations have called for improved, systematic international cooperation to facilitate the rapid deployment and the effective use of such resources for disaster mitigation and relief. Most recently, in 1994, the International Telecommunication Union World Telecommunication Development Conference adopted Resolution 7, on Disaster Communications, which the International Telecommunication Union Plenipotentiary Conference endorsed in Resolution 36, on Telecommunications for Disaster Mitigation and Disaster Relief Operations.

In response to these activities, the Working Group on Emergency Telecommunications—a forum through which international, governmental, and non-governmental humanitarian organizations work to increase their effectiveness by addressing regulatory, operational, and technical aspects of emergency telecommunications—has developed this Convention on the Provision of Telecommunication Resources for Disaster Mitigation and Relief Operations. The Convention is designed to be effective and pragmatic. Although it is necessarily an agreement among States, the drafters have, where possible, crafted its provisions to facilitate the vital humanitarian efforts of inter-governmental and non-governmental organizations as well. The Convention reflects many compromises and therefore does not necessarily reflect the views of any single participant in the Working Group.

Comments regarding this draft are welcome and should be directed to the Working Group's Secretariat, to the attention of Hans Zimmermann, United Nations Department of Humanitarian Affairs, Palais des Nations, CH-1211 Geneva 10, telephone +41 22 917-3516, facsimile +41 22 917-0023, e-mail hans.zimmermann@itu.ch. To contact the drafters directly e-mail fcate@indiana.edu.

The notes start off by again explaining the importance of telecommunications in disaster situations, and then explain the 'history' of the previously mentioned documents. An interesting paragraph explains that though the convention will be among States, that is sovereign governments (countries), the principles will also apply to non governmental organisation (NGOs) as well.

The document opens with the statement 'The state parties to this convention'. What they mean is that they wish representatives of governments to sign up to agree to the convention that follows. This means as usual that governments not agreeing to this convention are not obliged to offer you the privileges that the convention requires, if they are not signatories. It is always the case that you are under the authority of the sovereign government who's territory you are in. However it is in the interest of all NGO's and especially those involved with telecommunications, to see that states sign this convention.

Article 1-Definitions

Article 2-General Provisions

Article 3-Provision of Telecommunication Assistance

Article 4-Direction and Control of Telecommunication Assistance

Article 5-Privileges, Immunities, and Facilities

Article 6-Termination of Assistance

Article 7-Payment or Reimbursement of Costs or Fees

Article 8-Transit of Personnel, Equipment, Materials, and Information

Article 9-Telecommunication Resources Inventory

Article 10-Telecommunication Assistance Action Plan

Article 11-Regulatory Barriers

Article 12-Competent Authorities and Points of Contact

Article 13-Relationship to Other International Agreements

Article 14-Dispute Settlement

Article 15-Entry Into Force

Article 16-Provisional Application

Article 17-Amendments

Article 18-Reservations

Article 19-Denunciation

Article 20-Depositary

Article 21-Operational Coordinator

Article 22-Technical Coordinator

Article 23-Authentic Texts and Certified Copies

THE STATES PARTIES TO THIS CONVENTION,

RECOGNIZING that the magnitude, complexity, frequency, and impact of disasters are increasing at a dramatic rate, with particularly severe consequences in developing countries,

RECALLING that humanitarian relief and assistance agencies require reliable, flexible telecommunication resources to perform their vital tasks,

CONVINCED that the effective, timely deployment of telecommunication resources and that rapid, efficient information flows are essential to reducing loss of life, human suffering, and damage to property and the environment caused by disasters,

CONCERNED about the impact of disasters on communication facilities and information flows,

REAFFIRMING the absolute priority accorded emergency life-saving communications in more than fifty international regulatory instruments, including the Constitution of the International Telecommunication Union,

NOTING the history of international cooperation and coordination in disaster mitigation and relief, including the demonstrated life-saving role played by the timely deployment and use of telecommunication resources,

FURTHER NOTING the Proceedings of the International Conference on Disaster Communications, Geneva, 1990, addressing the power of telecommunication systems in disaster recovery and response,

FURTHER NOTING the urgent call found in the Tampere Declaration on Disaster Communications, Tampere, 1991, for reliable telecommunication systems for disaster mitigation and disaster relief operations, and for an international Convention on Disaster Communications to facilitate such systems,

FURTHER NOTING United Nations General Assembly Resolution 44/236, designating 1990-2000 the International Decade for Natural Disaster Reduction, and Resolution 46/182, calling for strengthened international coordination of humanitarian emergency assistance,

FURTHER NOTING the prominent role given to communication resources in the Yokohama Strategy and Plan of Action for a Safer World, adopted by the World Conference on Natural Disaster Reduction, Yokohama, 1994,

FURTHER NOTING Resolution 7 of the first World Telecommunication Development Conference, Buenos Aires, 1994, endorsed by Resolution 36 of the Plenipotentiary Conference of the International Telecommunication Union, Kyoto, 1994, urging administrations to take all practical steps for facilitating the rapid deployment and the effective use of telecommunication equipment for disaster mitigation and relief operations by reducing and, where possible, removing regulatory barriers and strengthening cooperation among States,

WITH REFERENCE to the conclusions of the Working Group on Emergency Telecommunications regarding the critical role of telecommunications in disaster mitigation and relief, SUPPORTED by the work of many States, United Nations entities, governmental, inter-governmental, and non-governmental organizations, humanitarian agencies, telecommunication equipment and service providers, media, universities, and communication- and disaster-related organizations to improve and facilitate disaster-related communications,

DESIRING to ensure the reliable, rapid availability of telecommunication resources for disaster mitigation and relief operations, and >

FURTHER DESIRING to facilitate international cooperation to mitigate the impact of disasters,

HAVE AGREED as follows:

ARTICLE 1

Definitions

Unless otherwise indicated, the terms set out below shall have the following meanings:

1. "Disaster" means a serious disruption of the functioning of the society, posing a significant, widespread threat to human life, health, property, or the environment, whether caused by accident, nature, or human activity, and whether developing suddenly or as the result of complex, long-term processes.

2. "Natural hazard" means a naturally occurring event or process, such as an earthquake, flood, wind, landslide, avalanche, cyclone, tsunami, insect infestation, drought, or volcanic eruption, which has the potential for triggering a disaster.

3. "Health hazard" means a sudden outbreak of infectious disease, such as an epidemic or pandemic, or other event posing a significant threat to human life or health, which has the potential for triggering a disaster.

4. "Disaster mitigation" means measures designed to prevent, predict, prepare for, respond to, and/or mitigate the impact of, disasters.

5. "Telecommunications" means any transmission, emission, or reception of signs, signals, writing, images, sounds, or intelligence of any nature, by wire, radio, optical fiber, or other electromagnetic system.

6. "Telecommunication resources" means personnel, equipment, materials, information, radio frequency spectrum, network or transmission capacity, or other resources necessary to telecommunications.

7. "Telecommunication assistance" means the provision of telecommunication resources or other resources or support intended to facilitate the use of telecommunication resources.

8. "Requesting State Party" means a State Party to this Convention requesting telecommunication assistance pursuant hereto.

9. "Assisting State Party" means a State Party to this Convention providing telecommunication assistance pursuant hereto.

10. "This Convention" means the Convention on the Provision of Telecommunication Resources for Disaster Mitigation and Relief Operations.

11. "The depositary" means the depositary for this Convention, as set forth in Article 20.

12. The "operational coordinator" means the entity which will coordinate requests for telecommunication assistance, as set forth in Article 21.

13. The "technical coordinator" means the entity which is responsible for maintaining and disseminating information related to telecommunication resources for disaster mitigation and relief, as set forth in Article 22.

This contains the definitions of the terms used in the document. An interesting move is that the term 'telecommunications resources' will mean the people as well as the equipment used in the assistance. This is a most reassuring move for those carrying the stuff about.

There are two interesting definitions. The 'Operational Co-ordinator', will co-ordinate the telecommunications resources as they are sent to the field. And the 'Technical Co-ordinator' who is supposed to know where the required equipment is and how to get it on site quickly. This implies management of some kind of data base. These person will need much good will and practical support from all NGO's. This function will be done by some or other institution rather than an individual person, and at this time the identity of that institution has not been decided. However preliminary discussions indicate that the operational co-ordinator may be the UN Department of Humanitarian Affairs (DHA) and the technical co-ordinator may be the International Telecommunications Union (ITU). This has not been settled yet and so the WGET are inviting comments from interested parties.

ARTICLE 2

General Provisions

1. The States Parties shall cooperate among themselves and with governmental, inter-governmental, and non-governmental organizations, in accordance with the provisions of this Convention, to facilitate the use of telecommunication resources for disaster mitigation and relief.

2. Such use may include, but is not limited to:

a. The deployment of terrestrial and satellite telecommunication equipment to predict, monitor, and provide early warning of natural hazards, health hazards, and disasters;

b. The sharing of information about natural hazards, health hazards, and disasters among the States Parties and with other States and governmental, inter-governmental, and non-governmental organizations, and the dissemination of such information to the public, particularly to at-risk communities;

c. The provision of prompt telecommunication assistance to mitigate the impact of a disaster; and

d. The installation and operation of reliable, flexible telecommunication services to be used by humanitarian relief and assistance organizations.

3. To facilitate such use, the States Parties may conclude additional multinational or bilateral agreements or arrangements.

4. The States Parties request the United Nations [organization], with the collaboration of the International Telecommunication Union and other relevant United Nations entities, to use its best efforts, in accordance with the provisions of this Convention, to:

a. Develop, in consultation with the States Parties, model agreements that may be used to provide a foundation for multinational or bilateral agreements facilitating the provision of telecommunication resources for disaster mitigation and relief;

b. Develop, operate, and maintain information collection and dissemination procedures and systems necessary for the implementation of the Convention; and

c. Inform States of the terms of this Convention, and to facilitate and support the cooperation among States Parties provided for herein.

5. The States Parties shall cooperate among themselves to improve the ability of governmental, inter-governmental, and non-governmental organizations concerned with disaster mitigation and relief to support the objectives of this Convention.

This article stresses the cooperation between states and NGOs and also while mentioning some of the things that need to be done, makes the interesting point that the cooperation is not limited to the things mentioned in the convention. This is good because technology moves along rather quickly and sometimes legislation does not keep up. If you need something not covered by the convention, you could point to this to see if the state party you are dealing with is as flexible as this convention was meant to be.

The convention also says that the UN and the ITU will work to format model agreements that can be used to formulate agreements with state parties, and that they will work to make the provision of the convention better understood and practical. They will also have the huge task of working out the information data bases needed to find equipment and get it moved to the field quickly. I have done this on a small scale for the DRCF and I can assure you that it is a huge task. Again we will need to cooperate to the utmost with this work if it is to succeed as well as we would all want.

ARTICLE 3

Provision of Telecommunication Assistance

1. A State Party requiring telecommunication assistance for disaster mitigation and relief may request such assistance from any other State Party, either directly or through the operational coordinator. Upon receipt of a request for telecommunication assistance, the operational coordinator shall immediately disseminate such request to all other appropriate States Parties.

2. A State Party requesting telecommunication assistance shall specify the scope and type of assistance required and, where practicable, provide the State Party to which the request is directed and/or the operational coordinator with such information as may be necessary to determine the extent to which such State Party is able to meet the request.

3. Each State Party to which a request for telecommunication assistance is directed, either directly or through the operational coordinator, shall promptly determine and notify the requesting State Party whether it will render the assistance requested-directly or through a governmental, inter-governmental, non-governmental, or private organization-and the scope of, and terms, conditions, restrictions, and cost, if any, applicable to such assistance.

4. No telecommunication assistance shall be provided by any State Party pursuant to this Convention without the consent of the requesting State Party. The requesting State Party shall retain the authority to reject all or part of any telecommunication assistance offered by another State Party in accordance with the requesting State Party's existing national law and policy.

To avoid confusion, the state requesting the telecommunications assistance can do so through an 'operational co-ordinator' (it has not been decided who this will be at time of writing). This is good because deploying technical equipment needs technical and logistical skills which are highly specific. It is best done by someone who really understands the technology, the needs of the field personnel and also the limitations as to what is practical. Another obvious need is for the 'requesting state party', (that is the one having the disaster and needing help), to explain

how much and of what they need. This is so that the right amount of the right equipment can be provided and unnecessary equipment is not sent out.

If someone has been asked to help, they must say if they can or not as soon as possible, so that alternative help can be provided if they cannot help. If they plan to help but have some conditions, (for example about how much the help will cost), then they must state them at the start, to avoid bitter arguments after the event.

Also, any state or NGO should only send help if they have been asked for that help by the 'requesting state party'. Unwanted 'disaster tourists', (as some see them), can cause more work than they achieve. The 'requesting state party' has the right to refuse to accept any help they don't need, which is fair as uncoordinated foreigners who don't speak the language, charging about in a disaster zone will need protecting and feeding. They may be more trouble than they are worth, despite the obvious good-will they show. I don't know of any fire chief who lets passers-by rush into burning buildings to throw random buckets of water willy nilly, so you can see why we NGO's must demonstrate our maturity before we will be trusted.

You should always remember that no matter what the situation is, you are a guest in that country and must behave as such. You are still subject to their laws, and must obey their directions. Don't become full of your own importance and try to 'lord it' over the local people. Apart from the fact that this is illegal it is also bad form, you will give other NGO's a bad name, and undo years of good work by those who have spent a lifetime building up fragile co-operation. Disaster operations give you a powerful charge of adrenaline, you must understand what is happening to your body and control yourself.

ARTICLE 4

Direction and Control of Telecommunication Assistance

Unless otherwise agreed:

1. The overall direction, control, coordination, and supervision of telecommunication assistance shall be the responsibility, within its territory, of the requesting State Party.
2. The requesting State Party shall provide, to the extent of its capabilities, local facilities and services for the proper and effective administration of the telecommunication assistance, including ensuring that telecommunication equipment brought into its territory pursuant to this Convention shall be expeditiously licensed or shall be exempt from licensing in accordance with its domestic laws and regulations.
3. The requesting State Party shall ensure the protection of personnel, equipment, and materials brought into its territory by or on behalf of the assisting State Party under the terms of this Convention.
4. The requesting State Party shall not, in exercising direction and control of telecommunication assistance provided for under this Article, direct the deployment or use of any telecommunication resources provided pursuant to this Convention for purposes not directly related to predicting, preparing for, responding to, mitigating the impact of, or providing relief during and following disasters.
5. Ownership of equipment and materials provided by any State Party pursuant to this Convention shall be unaffected by their use under the terms of this Convention, and their prompt return to the proper assisting State Party shall be guaranteed.
6. This Article shall apply to any requesting State Party, in whose territory telecommunication assistance is provided for disaster mitigation and relief, irrespective of whether such assistance is provided by a State not a party to this Convention, governmental, inter-governmental, or non-governmental organization, provided that:
 - a. The requesting State Party has consented to, and has not terminated, such provision of telecommunication

assistance for disaster mitigation and relief;

b. The State, governmental, inter-governmental, or non-governmental organization providing such telecommunication assistance acts in accordance with this Article and Articles 3 and 5; and

c. The application of this Article is not inconsistent with any other agreement between the requesting State Party and the State, governmental, inter-governmental, or non-governmental organization providing such telecommunication assistance.

The 'requesting state party' will be in control of the operation and so they are required to see to several needs of the helpers. For example that the people and their equipment can pass through the airport without being arrested and impounded for illegally 'importing' equipment without a licence (which does happen). They are also required to 'protect' the equipment and persons.

However in deploying the telecommunications assistance, they may use it only for the purpose of providing relief as specified when they asked for the help. Therefore you are not obliged to act as a private message service for the government or any other agency if you feel that what you are doing is not related to the disaster, (as sometimes happens to relief resources).

You still retain ownership of any equipment that is yours, at all stages of the operation. The requesting state party are obliged to make sure that it is returned to you at the end of the operation or at any time that you request. This means that you must thoroughly mark all of your equipment so that there can be no misunderstanding. Paint it your colours or paint your logo all over it. Put your name and address and the international inventory number prominently somewhere on it. Clearly mark it as something like 'Humanitarian Assistance' or 'Disaster/Emergency equipment' so that it does not get swept into the store with the other commercial stuff at the airport and gather dust or worse for months.

These rules will apply to the property and personnel of any genuine helpers regardless of whether they have signed the convention or not, (or are eligible to sign this convention, for example NGO's), provided that they have not been asked to leave, or some special arrangement exists between the requesting state party and the helpers.

ARTICLE 5

Privileges, Immunities, and Facilities

1. The requesting State Party shall afford to persons, other than its nationals, and to organizations, other than those domiciled within its territory, who act pursuant to this Convention and who have been duly notified to, and accepted by, the requesting State Party, the necessary privileges, immunities, and facilities for the performance of their proper functions, including, but not limited to:

a. Immunity from arrest, detention, and legal process, including criminal, civil, and administrative jurisdiction of the requesting State Party, in respect of acts or omissions in the performance of their duties; and

b. Exemption from taxation, duties, or other charges, except for those which are normally incorporated in the price of goods or services, in respect of the performance of their duties.

2. The requesting State Party shall:

a. Afford the assisting State Party exemption from taxation, duties, or other charges on the equipment, materials, and other property brought into the territory of the requesting State Party by the assisting State Party for the purpose of providing telecommunication assistance under this Convention; and

b. Provide immunity from seizure, attachment, or requisition of such equipment, materials, and property.

3. The requesting State Party shall ensure the prompt return of such equipment, material, and property to the proper

assisting State Party.

4. Nothing in this Article shall require any State Party to provide its nationals or permanent residents, or organizations domiciled within its territory, with privileges and immunities.

5. Without prejudice to their privileges and immunities in accordance with this Article, all persons entering the territory of a State Party for the purpose of providing telecommunication assistance or otherwise facilitating the use of telecommunication resources pursuant to this Convention, and all organizations providing telecommunication assistance or otherwise facilitating the use of telecommunication resources pursuant to this Convention, have a duty to respect the laws and regulations of that State Party. Such persons and organizations also shall have a duty not to interfere in the domestic affairs of the State Party into whose territory they have entered.

6. Nothing in this Article shall prejudice the rights and obligations with respect to privileges and immunities afforded to persons and organizations participating directly or indirectly in telecommunication assistance, pursuant to other international agreements (including the Convention on the Privileges and Immunities of the United Nations, adopted by the General Assembly on February 13, 1946, and the Convention on the Privileges and Immunities of the Specialized Agencies, adopted by the General Assembly on November 21, 1947), or the rules of customary international law.

7. This Article shall apply to any requesting State Party, in whose territory telecommunication assistance is provided for disaster mitigation and relief, irrespective of whether such assistance is provided by a State not a party to this Convention, governmental, inter-governmental, or non-governmental organization, provided that:

a. the requesting State Party has consented to, and has not terminated, such provision of telecommunication assistance for disaster mitigation and relief;

b. the State, governmental, inter-governmental, or non-governmental organization providing such telecommunication assistance acts in accordance with this Article and Articles 3 and 4; and

c. the application of this Article is not inconsistent with any other agreement between the requesting State Party and the State, governmental, inter-governmental, or non-governmental organization providing such telecommunication assistance.

Any host is obliged to take care of the invited guests, and this is also the case with this convention. Helpers must be immune from arrest, detention and legal processes connected with doing their job. However don't think that you are some kind of VIP with diplomatic immunity, this is not so. This provision only relates to the actual work functions. What you are doing, operating a telecommunications system without a licence and with equipment upon which no excise duty has been paid, is absolutely illegal! This provision is only to offer privileges to do what is necessary to do the job at hand, nothing more.

Para 5 reminds guests that they are obliged not to interfere with the internal matters of the requesting state party. This includes not even giving the impression that you are attempting to do so. Many come from states where free expression is normal. It is easy to pass the time by moaning and complaining about the government. In the west, many popular forms of entertainment have made an industry of it. However in some cultures, the host is expected to apologise for the kitchen, the guest must vigorously contradict and declare the food delicious, to do anything else would be a big faux pas.

It has happened that journalists and other agents take 'off the record' remarks out of context and this has caused big problems. Your hosts may be excited to meet such an exotic foreigner as you and ask questions out of curiosity, but you must avoid the temptation to put the world to rights, or tell officials "you know what is wrong with this, don't you? You should....".

ARTICLE 6

Termination of Assistance

1. The requesting State Party or the assisting State Party may, at any time, after appropriate consultations and by notification in writing, request the termination of telecommunication assistance received or provided under Article 3. Upon such a request, the States Parties involved shall consult with each other to provide for the proper and expeditious conclusion of the assistance.

2. Any State Party requesting termination of telecommunication assistance shall notify the operational coordinator of such request. The operational coordinator shall provide such assistance as is requested and necessary to facilitate the conclusion of the telecommunication assistance.

Either the requesting state party or the assisting state party (or NGO) can decide when to go home. However it has to be done decently. There must be consultation and a written notification that the assistance is terminated. You must go home when the requesting state party says so, even if you disagree with them. If it is time to go, the operational co-ordinator and the requesting state party will help you to get your equipment and people back home. They should not abandon you to fend for yourself (which has happened to DRCF).

ARTICLE 7

Payment or Reimbursement of Costs or Fees

1. The States Parties may condition the provision of telecommunication assistance or other telecommunication resources for disaster mitigation and relief, upon agreement to pay or reimburse specified costs or fees.

2. Where such condition exists, the States Parties shall set forth in writing, prior to the provision of telecommunication assistance or other telecommunication resources:

a. The requirement for payment or reimbursement;

b. The amount of such payment or reimbursement or terms under which it shall be calculated; and

c. Any other terms, conditions, or restrictions applicable to such payment or reimbursement, including, but not limited to, the currency in which such payment or reimbursement shall be made.

3. The requirements of paragraphs 2(b) and 2(c) of this Article may be satisfied by reference to published tariffs, rates, or prices

4. In order that the negotiation of payment and reimbursement agreements does not unduly delay the provision of telecommunication assistance, the operational coordinator shall develop, in consultation with the States Parties, a model payment and reimbursement agreement that may provide a foundation for the negotiation of payment and reimbursement obligations under this Article.

5. No State Party shall be obligated to make payment or reimbursement of costs or fees under this Convention without having first expressed its consent to the terms provided by an assisting State Party pursuant to paragraph 2 of this Article.

6. Where the provision of telecommunication assistance or other telecommunication resources is properly conditioned upon payment or reimbursement of costs or fees under this Article, such payment or reimbursement shall be provided promptly after the assisting State Party has presented its request for payment or reimbursement.

7. Funds paid or reimbursed by a requesting State Party in association with the provision of telecommunication assistance shall be freely transferrable out of the jurisdiction of the requesting State Party and shall not be delayed or withheld.

8. A State Party properly entitled to receive payment or reimbursement of costs or fees associated with the provision of telecommunication assistance under this Article, may freely transfer such entitlement, unless such State Party has previously agreed otherwise.

9. In determining whether to condition the provision of telecommunication assistance or other telecommunication resources upon an agreement to pay or reimburse specified costs or fees, the amount of such costs or fees, and the terms, conditions, and restrictions associated with their payment or reimbursement, the States Parties shall take into account, among other relevant factors:

- a. The nature of the disaster, natural hazard, or health hazard;
- b. The impact, or potential impact, of the disaster;
- c. The place of origin of the disaster;
- d. The area affected, or potentially affected, by the disaster;
- e. The occurrence of previous disasters and the likelihood of future disasters in the affected area;
- f. The capacity of each State affected by the disaster, natural hazard, or health hazard to prepare for, or respond to, such event; and
- g. The needs of developing countries.

This is a major sore point with small NGO's, who do not have the budgets to absorb even one telecommunications bill. The excitement of the field operations is soon replaced by a dreaded sword of Damocles hanging over your head upon return to base. There are lots of bad stories of heartbreak and severe stress about this.

In fact if you are going to ask for payment in any form for the services you expect to render, you must clearly say so in advance of providing any services. If you are confident (or have a sponsor who will underwrite the costs), you may not make pre-conditions to the offer of help. However if you do decide to set conditions, such as that all cost must be paid in full before the next monthly bill is due, then you should clearly state what the conditions are when you make your offer of help. However you may decide to make the condition on the basis of the tariffs in force at the time of the operation.

The last thing that anyone wants is to waste time haggling over bills when emergency help is needed at once. Accordingly the operational co-ordinator will develop model agreements so that you can just choose one 'off the shelf' that suits how your NGO operates. The requesting state party is then obliged to make sure that you can be paid promptly, by removing red tape delays.

The prospect of huge bills may cause some states to feel reluctant to have to find large sums for hi-tech communications that they can ill afford, leading to the non-application of telecommunications resources. The assisting states (and NGO's) should bear that in mind when billing, and take into account factors that may indicate that help or part help is appropriate.

ARTICLE 8

Transit of Personnel, Equipment, Materials, and Information

Each State Party shall, at the request of any other State Party, facilitate the transit into, out of, and through its territory of personnel, equipment, materials, and information involved in the use of telecommunication resources for disaster mitigation and relief.

It often happens that you have to pass through one country to get to another, or that you have a stop off on the way. This article requests that the state party that you are transiting through, helps you get along as quickly and smoothly as possible. This includes all the effort needed to move the people as well as the equipment through the country.

ARTICLE 9

Telecommunication Resources Inventory

1. Each State Party shall maintain a current inventory identifying those resources which could be made available to facilitate the use of telecommunication resources for disaster mitigation and relief, including the provision of telecommunication assistance.
2. Such inventory may include, at the discretion of the State Party, resources available from governmental, non-governmental, and private organizations.
3. Each State Party shall endeavour to identify specifically those resources that are potentially available for the provision of telecommunication assistance and the cost and other terms, conditions, and restrictions, if any, associated with their provision.
4. Each State Party shall provide a copy of its inventory to the technical coordinator, and shall endeavour to revise that inventory as necessary.
5. The technical coordinator shall maintain copies of all telecommunication resources inventories received from States Parties, and shall expeditiously disseminate such inventories to the States Parties, to other States, and to governmental, inter-governmental, non-governmental, and private organizations with a legitimate interest in disaster preparedness and response, unless a State Party has previously specified, in writing, that distribution of its telecommunication resources inventory be restricted.

Before we can offer help with people and equipment, we obviously need to know who and what is available and where. therefore each state party and NGO needs to make an inventory, and importantly, keep it up to date. This information then needs to be passed along to the technical co-ordinator. Among information you should provide is what are the conditions and restrictions applying to the help, such as how long someone or something is available and what the cost will be of borrowing something. The technical co-ordinator will then pass along the information to anyone with a legitimate interest in disaster communications, (unless you say not).

ARTICLE 10

Telecommunication Assistance Action Plan

1. Each State Party shall endeavour to create a telecommunication assistance action plan that identifies and coordinates those steps necessary to deploy the telecommunication resources identified on that State Party's telecommunication resources inventory upon receipt and acceptance of a request for telecommunication assistance from a requesting State Party.
2. Each State Party shall provide a copy of its action plan to the technical coordinator, and shall endeavour to revise that plan as necessary.
3. The technical coordinator shall maintain copies of all telecommunication assistance action plans received from States Parties, and shall expeditiously disseminate such action plans to the States Parties, to other States, and to governmental, inter-governmental, non-governmental, and private organizations with a legitimate interest in disaster preparedness and response, unless a State Party has previously specified, in writing, that distribution of its telecommunication assistance action plan is be restricted.

Having equipment in store somewhere is no good at all unless we know who has the key and how to get it to the airport. Therefore state parties and NGOs must also file an action plan with the technical co-ordinator specifying how to deploy the men and equipment quickly. I find that this is the kind of thing that changes most rapidly, so again it is important to keep this revised regularly.

ARTICLE 11

Regulatory Barriers

1. The States Parties shall, where possible, reduce, or remove regulatory barriers to the use of telecommunication resources for disaster mitigation and relief, including to the provision of telecommunication assistance.
2. Regulatory barriers may include, but are not limited to:
 - a. Regulations restricting the import or export of telecommunication equipment;
 - b. Regulations restricting the use of telecommunication equipment or of radio frequency spectrum;
 - c. Regulations restricting the movement of personnel who operate telecommunication equipment or who are

essential to its effective use;

d. Regulations restricting the transit of telecommunication resources into, out of, and through the territory of a State Party; and

e. Delays in the administration of such regulations.

3. Reduction of regulatory barriers may take the form of, but shall not be limited to:

a. Revising regulations;

b. Exempting specified telecommunication resources from the application of those regulations during the use of such resources for disaster mitigation and relief;

c. Pre-clearance of telecommunication resources for use in disaster mitigation and relief, in compliance with those regulations;

d. Expedited review of telecommunication resources for use in disaster mitigation and relief, in compliance with those regulations; and

e. Temporary waiver of those regulations for the use of telecommunication resources for disaster mitigation and relief.

4. Each State Party shall notify the technical coordinator and the other States Parties, directly or through the technical coordinator, of:

a. Measures taken, pursuant to this Convention, for reducing or removing such regulatory barriers;

b. Procedures available, pursuant to this Convention, to States Parties, States, and/or governmental, inter-governmental, non-governmental, and private organizations, for the exemption of specified telecommunication resources used for disaster mitigation and relief from the application of such regulations, pre-clearance or expedited review of such resources in compliance with applicable regulations, or temporary waiver of such regulations otherwise applicable to such resources; and

c. The terms, conditions, and restrictions, if any, associated with the use of such procedures.

5. The technical coordinator shall regularly and expeditiously make available to the States Parties, to other States, and to governmental, inter-governmental, non-governmental, and private organizations with a legitimate interest in disaster preparedness and response, an up-to-date listing of such measures, their scope, and the terms, conditions, and restrictions, if any, associated with their use.

You may think that when they hear of a huge disaster affecting millions of lives, authorities would be eager to rush through any help that would speed along assistance but not so. In fact when an emergency communicator arrives at the airport in the requesting state, he will be met by immigration, and customs officials who work to strict orders from their government. These are toughened people and are quite used to hearing all sorts of 'stories' from professional 'travellers', the more wild your story, the less they will believe you. (they are usually quite right!).

These men will not risk their careers by exceeding their authority, so they will insist on the letter of the law, and finding that you have no licence to import the equipment, will impound the equipment. They may also detain you (without air conditioning) for importing equipment illegally and for trying to set up an illegal telecommunications network without a permit.

Even if you 'smuggle' the equipment in some how, If you are caught using, for example, VHF radio, without having a licence for the frequency you are using, you will get into very big trouble. In many states you need to have clearance from the security services at the very highest level in order just to be in possession of a radio transmitter. You may be accused of spying, misjudging this matter will put you in severe distress.

The purpose of article 11 is to urge states to reduce or remove these barriers. In other words to make it possible for customs and immigration to let you pass without breaking any local laws. It is worth saying that international law does not apply in this kind of case, only national law does, so no matter what the officials of the requesting state order you to do or not do, you must comply (if you agree or not).

ARTICLE 12

Competent Authorities and Points of Contact

1. Each State Party shall notify the technical coordinator of its competent authorities and point(s) of contact responsible for complying with the terms of this Convention and authorized to request, offer, accept, and terminate telecommunication assistance.
2. Each State Party shall promptly inform the technical coordinator of any changes in the competent authorities and point(s) of contact provided pursuant to paragraph 1 of this Article.
3. The technical coordinator shall regularly and expeditiously make available to the States Parties, to other States, and to governmental, inter-governmental, non-governmental, and private organizations with a legitimate interest in disaster preparedness and response, an up-to-date listing of all States Parties' competent authorities and point(s) of contact under this Convention.

In order that the operational co-ordinator and technical co-ordinator know that they are working with people in the requesting state who understand what to do and how, each state party must say who the contact people are in their state, and keep this up to date. The technical co-ordinator will have to keep this information up to date and pass it on to everyone.

ARTICLE 13

Relationship to Other International Agreements

This Convention shall not affect the rights and obligations of States Parties under existing international agreements, future international agreements concluded in accordance with the object and purpose of this Convention, or the rules of customary international law.

This convention does not overrule or replace any existing international bilateral or multilateral agreement.

ARTICLE 14

Dispute Settlement

1. In the event of a dispute between States Parties concerning the interpretation or application of this Convention, the States Parties to the dispute shall consult for the purpose of settling the dispute by any peaceful means acceptable to them. Such consultation shall begin promptly upon the written declaration, delivered by one State Party to another State Party, of the existence of a dispute under this Convention. The State Party making such a written declaration of the existence of a dispute shall promptly deliver a copy of such declaration to the depositary.
2. If a dispute between States Parties cannot be settled within [six months] of the date of delivery of the written declaration to a State Party to the dispute, the States Parties to the dispute may request any other State Party or organization to use its good offices to facilitate settlement of the dispute.
3. If neither State Party seeks the good offices of another State Party, State, or organization, or if the exercise of good offices fails to facilitate a settlement of the dispute within [six months] of the request for such good offices being made, then either State Party to the dispute may:
 - a. Request that the dispute be submitted to binding arbitration; or
 - b. Submit the dispute to the International Court of Justice for decision, provided that both States Parties to the dispute are subject
to the jurisdiction of the International Court of Justice.
4. In the event that the respective States Parties to the dispute request that the dispute be submitted to binding arbitration and submit the dispute to the International Court of Justice for decision, the submission to the International Court of Justice shall have priority.

In the case of disagreement between state parties, the two parties may resolve their argument peacefully by various means, ranging from arbitration to the international court of justice.

ARTICLE 15

Entry Into Force

1. This Convention shall be open for signature by all States at the offices of the depositary, beginning [date].
2. A State may express its consent to be bound by this Convention by signature, by signature made subject to ratification, acceptance, or approval, by deposit of an instrument of ratification, or by deposit of an instrument of accession.
3. The Convention shall enter into force thirty days after consent to be bound has been expressed by [six] States.
4. For each State expressing consent to be bound by this Convention after its entry into force, this Convention shall enter into force for such State thirty days after the date of expression of consent.

The convention is really only 'live' if six or more state parties sign up for it. Then it becomes binding on the state that has signed up thirty days after the signing. The number of state parties that trigger the convention coming into effect is still being debated. Six seems a likely compromise.

ARTICLE 16

Provisional Application

A State may, upon signature or at any later date before this Convention enters into force for such State, declare that it will apply this Convention provisionally.

ARTICLE 17

Amendments

1. A State Party may propose amendments to this Convention by submitting such amendments to the depositary, who shall circulate them to the other States Parties.
2. Any amendment approved by two-thirds of all States Parties shall be laid down in a protocol which is open for signature at the depositary by all States Parties.
3. The protocol shall enter into force thirty days after [six] States Parties have indicated their consent to be bound thereby. For each State Party expressing consent to be bound by the protocol after its entry into force, the protocol shall enter into force for that State Party thirty days after the date of expression of consent.
4. Upon the motion of any State Party and with the approval of a majority of States Parties, a conference shall be convened to review the operation of this Convention and to evaluate the need for modifications or amendments hereto. Such conferences shall begin not sooner than thirty days after the invitations are issued. Amendments recommended at such conferences shall be considered for adoption in accordance with paragraphs 2 and 3 of this Article.

A state party can propose an amendment and then leave the amendment open for discussion. The amendment can be a new idea to speed things up, or perhaps more ifs and buts that could slow things down. In any case, if the amendment has the support of two thirds of the states, then it can become a formal 'protocol' defining some new understanding. Once more than six states have signed the protocol, it becomes binding to them thirty days later.

At any time, any state party can call for a conference reviewing the operation of the convention and this will be called if the majority of the states agree. The conference must then take place thirty days after the invitations have been issued.

ARTICLE 18

Reservations

1. When signing, accepting, ratifying, approving, or acceding to this Convention or any amendment hereto, a State Party may make reservations to paragraph 6 of Article 4, to paragraphs 1, 2, and 7 of Article 5, and to Article 14.

2. A State Party may at any time withdraw its prior reservation by written notification to the depositary. Such withdrawal of a reservation becomes effective immediately upon notification to the depositary.

If any state party signing up has second thoughts about certain parts of the convention , those mentioned in the draft, they can say so when they sign, but if they change their minds and decide to go the whole hog after all, they can notify the depositary, (the people who keep the convention and administer it). Actually state parties can only reserve against certain specific provision (primarily those dealing with sovereignty and the extension of the convention to non-states). The rest of the convention is take-it-or-leave-it.

ARTICLE 19

Denunciation

1. A State Party may denounce this Convention by written notification to the depositary.

2. Denunciation shall take effect thirty days following the date on which the notification is received by the depositary.

3. All copies of the telecommunication resources inventory, telecommunication assistance action plan, and list of measures adopted and procedures available for reducing regulatory measures provided by any State Party denouncing this Convention shall be deleted by the effective date of such denunciation.

A state party may decide to pull out of the agreement at any time by notifying the depositary. If so they have to delete the information about resources and people that they gained while they were signatories.

ARTICLE 20

Depositary

1. The Secretary-General of the [to be decided] shall be the depositary of this Convention.

2. [Upon its being opened for signature, the depositary shall forward a copy of this Convention to the Secretary-General of the United Nations.]

3. The depositary shall promptly notify the States Parties, all other States[, and the Secretary-General of the United Nations] of:

a. Each signatory of this Convention and of any protocol or amendment thereof;

b. Each deposit of an instrument of ratification, acceptance, approval, or accession concerning this Convention and any protocol or amendment thereof;

c. Any declaration of provisional application of this Convention in accordance with Article 16;

d. Any reservation to this Convention notified to the depositary in accordance with Article 18;

e. The entry into force of this Convention and of any protocol or amendment thereof; and

f. Any denunciation of this Convention made under Article 19.

Someone has to be responsible for holding the 'master' copy of the convention, and knowing who has signed and who has not. They also let everyone know who is in and who is out of the 'club'. It is not yet decided who this will be at the time of writing. However, usually the UN secretary general is the depositary of agreements like this, but that is being discussed.

ARTICLE 21

Operational Coordinator

1. The [to be decided] shall be the operational coordinator for this Convention.

2. The operational coordinator shall cooperate closely with the technical coordinator in carrying out its responsibilities under this Convention.

ARTICLE 22

Technical Coordinator

1. The [to be decided] shall be the technical coordinator for this Convention.

2. The technical coordinator shall cooperate closely with the operational coordinator in carrying out its responsibilities under this Convention.

It is not yet decided who the Operational coordinator and the technical coordinator will be at time of writing, but the point is clear that these two must work closely together. It is suggested that the operational coordinator should be the UN Department of Humanitarian Affairs (DHA) and the technical coordinator should be the International Telecommunications Union (ITU). Both are based in Geneva, Switzerland and are within walking distance, so the two staffs could regularly lunch together, (which is a very good thing).

ARTICLE 23

Authentic Texts and Certified Copies

The original of this Convention, of which the Arabic, Chinese, English, French, Russian, and Spanish texts are equally authentic, shall be deposited with the depositary, who shall send certified copies to the States Parties and to all other States.

The depositary will keep master copies in various languages but each copy is equally valid as a master regardless of the language that it is in. The depositary then circulates copies of the master to the interested states.

5.20 Summary and remarks

I think that this is a most admirable convention, and it will go a long way to making sense of the problems of disaster communications, at last! However the road will probably not be smooth and many struggles could lie ahead. It is certainly in the interest of NGOs to support this work and co-operate fully with the convention. We should all take an active interest in promoting it, and in particular, interesting state parties to sign up for it. It is also going to be important for everyone to keep the operational co-ordinator informed as to how the arrangements are working out in the field, so that the convention can be fine tuned to avoid problems.

⁶³In some countries 'radio' is synonymous with 'spy', so possession of one without clearance from the state security services will get you in to a lot of trouble.

⁶⁴Disaster teams must be on the scene no later then 24HRS after first alert, including callout and travel time. Therefore there may be only a few hours to arrange for paperwork to be in order.

⁶⁵The declaration is now annexed to WTDC Nr7

CHAPTER 6

6.1 Introduction

In Part 1, "Disaster Communications-Global" (required reading) we have discussed the problems facing a disaster or aid team wishing to communicate with their office back in their home country. In this part we will turn to the problems of communications with and between members of the same team or group of teams in an area of about 100KM or so around a given point. So how complicated can that be? Well, it can be very simple if you wish, but also there are some cases where a more complicated set-up is justified.

I will try to mention just about every practical system we at DRCF have ever heard of. Just because we mention (or don't mention) a system, **this is not an endorsement of the idea**. We merely acquaint you with the facts and leave you to decide what you think is best for you. Reading this won't make you an expert, but it will help you and your experts to come to a better understanding

The Disaster Relief Communications Foundation (**DRCF**) is a Non Governmental Organisation (NGO), a small registered charity, and we admit that our resources are limited. However we do try most conscientiously to make sure that what we say is generally agreed to be true, or at least valid opinion, by experts in the relevant fields. However if you know of something better than we do, we most sincerely welcome input, for future revisions of the book.

6.2.1 For field telephones

Field telephones are ruggedised telephones often designed to be left outdoors during use. Before you roll your eyes upward and 'tut' at this section consider something. No lesser organisations than the BBC, and most armies of the world still use field telephone systems in 1996 though they could easily afford radio systems. To see why, let's look at what a field telephone system is and what its advantages over, say walkie-talkies are.

An ordinary telephone system relies on power from a central switchboard or Private Automatic Exchange (PAX). This scheme is called the central battery system. (CB).The problem is that if you lose the power to your switchboard, you lose all of the phones. For this reason, though the BBC has PAX telephones laid out in, for example, a commentary box at an Outside Broadcast (OB) they do not totally trust to this system. Engineers would find that when they needed it most, when some kind of problem occurs, it would let them down.

An alternative system is called the Local Battery system (LB). Incidentally this was the type of telephone first used by the Edison Bell telephone system in 1876 or so. They are usually distinguished by a rather comical looking crank handle sticking out of the front or side. This handle is called the Magneto handle, so the system is sometimes also called the Magneto system, though more modern designs are electronic and have a button marked 'call' or 'ring'. When the crank is turned (or the button pressed) the bell on the other phone rings.

The phones are connected up by wires. Just about any wire in existence is suitable, field telephones are not fussy. Large reels of Jumper wire or field telephone wire are very cheap, you can even use wire fences and an earth return . The phones are totally self contained, they don't need power or any kind of control system from anything else. This makes them very reliable indeed. To power the

microphone in the telephone, there is a built in 3v battery called the polarising battery. The very good news is that this battery can be just about any disposable battery you can buy from anywhere, such as a bicycle or torch battery, it is not special in any way and even the voltage is not critical. They are switched on either when the phone is lifted off the hook, or by pressing a button on the handset labelled 'press to talk'.

How long do the batteries last? Well that depends, but as a guide, I have a collection of field telephones at home. My two boys age 5 and 3 play with them, and rather roughly. Not only have they never been able to break them, but the batteries have to be changed only about once per year, and only then because of ageing. I have one phone which had the same battery in for 3 years, and still worked perfectly straight from storage when it was needed.

Field telephones are tough and totally reliable. You will never lose sleep over charging up the batteries every 8 hours as with a walkie talkie. In any case, you may not trust your generator or mains supply enough to be sure that there will be power to charge your radios, whereas the field telephone batteries will work even when nearly totally flat, so they won't let you down without warning. They are also immune from interference and channel overloading, which often dog 'walkie talkies'. Privacy is enhanced because listening in would involve line tapping which is much more trouble to do without being caught. This deters the casual listener who may be allocated the same channel, or the person with a scanner.

Walkie talkies have the problem that if put behind or inside a building or in a dip in the terrain, they will not work. Furthermore, you may not get any warning of this until you try and it doesn't work. Whereas field telephones will work anywhere that you can get a cable to. The range of field telephones is rather academic, but over 100km is possible. The limiting factor will be how much cable you can bring to the site and have time to 'string up'.

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The St.John Ambulance Brigade provide the First Aid coverage for the London Marathon, an event which generates marathon numbers of First Aid cases. VHF channels became so overloaded with higher priority calls that there was hardly ever time for the information about dropped out runners to be sent to HQ for logging. Worried relatives would realise that their loved ones had not finished the race, and go to the St.John information point asking for the whereabouts of their runner. This information was available on a computer in another wing of the same building, (County Hall) but quite a long distance away. A temporary field telephone line was installed in about an hour, and soon the information could be passed in seconds from desk to desk.

Field telephones can be readily and cheaply purchased from Army surplus or via magazines for about one tenth of the cost of a walkie talkie. They are also simpler in that you will not need a licence for them as they don't use a radio channel, neither do the operators need licences.

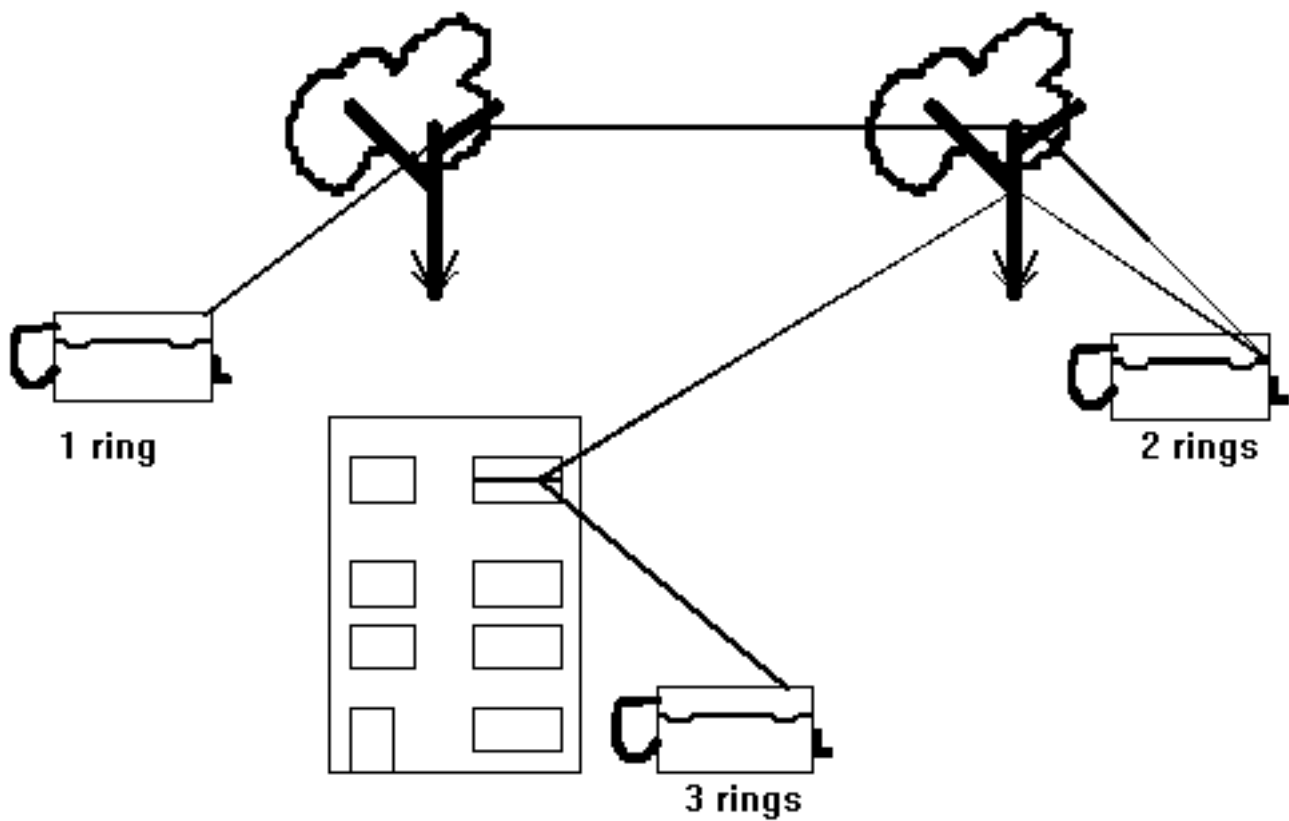


Fig 17 Field telephone systems lend themselves to improvised cabling schemes

6.2.2 Against field telephones

With all these selling points, why does everyone buy Walkie-talkies? The reason is , wires. The cost of wire of the type needed is actually very little - that is not the problem, the problem is the laborious task of stringing out the wires, a process called 'cabling'. This process does take some hours so it is unsuitable for anyone constantly on the move.

Here we need to make a clear distinction between the cabling techniques, each has its own style.

- Temporary cabling.
- Semi-Permanet cabling.
- Permanent cabling.

Temporary cabling is what your first response will be. This means getting the cable from A to B with the least effort, therefore the least time spent of rigging up. I can lay and fix one reel of line (about 500m) in about half an hour in this way. Sometimes you may just lay the wires on the ground, if out of the way of footpaths and roads, and then use handy trees or buildings as makeshift telegraph poles when a road crossing is required.

Inside buildings, the wire can be fed into a window and then loosely tied to light fittings or taped to corners until a suitable position for the phone is reached. The reliability of the link now depends on keeping the line out of harm's way, so this is where imaginative improvising comes in. The line will probably be broken a few times while the best route is found, but the lines can be rejoined without any special tools if this is the case.

If you do this in an urban environment, you must remember to look out for adjacent power cables and never cable over them, always well under. This is so that if your cable comes undone at one of the verandas you tied it to, it will go slack and not touch the power cable, maybe electrocuting the person using the phone.

Despite being in a rush, you must take care to tie the line securely over paths and roads to avoid trip or strangulation hazards. On the other hand, you would want to use few enough knots that when the operation is over, or if the phone's position is to be changed, you can quickly reach and undo all the knots you tied, allowing the cable to be easily reeled in without damage and re-used. Recovering a reel of cable takes about half an hour.

Sooner or later someone is going to complain about the scruffy wiring and the fact that they can't close the windows or doors properly. Then you will have to smarten things up with a semi-permanent scheme. This means tidying up the wiring by clipping or taping it to the skirting board or door frames of the rooms. You may have to drill a small hole in the door frames and window frames to let the cable pass through unseen and let the doors close properly. All of this will take much more time, about 1 or 2 hours per 100 m. You would do this when the line is established and the panic is over, (unless there was not immediate panic in the first place), in which case you should do a neat job the first time.

By the time the installation becomes semi-permanent and if the line has to cross someone else's property, the owner will soon complain if your wiring over or past his place is scruffy. Worst of all, when the immediate crisis is over, the local officials may complain about the wiring crossing public land and in particular public roads, (on the other hand, seeing the state of some overhead wiring in urban areas, no one may notice unless you are really bad). If things have got to the stage that the locals can worry about such things, then probably you can go home anyway, but if you are in for a longer term commitment, then you can't expect to do this for very long, and therefore field telephones will be best used on your own camp, building, area of responsibility or compound.

In many cases, where law and order has broken down, wire may be very valuable and so will be cut down and stolen for the copper. Even if the wire is not copper, they will cut it down and strip it to find out. This is a major problem in Africa for instance. Another problem is that in some countries, the government has a monopoly of communications of all sorts and so you will meet zealous opposition to unauthorised wires crossing public land.

6.2.3 Private Wires

If your installation is becoming more permanent, there is something else you may find worth while, a **Private wire**. If there is a telephone system in the town and if it is working, you should naturally use the phone to call the other offices that you need to contact. If the local phone system is not working or is not reliable, or the waiting time for connection is very long, you can make a special arrangement. In a 'private wire' scheme, one of the telephone lines around the area which would normally be connected to the local exchange, are diverted between the points you specify. If there is spare local cable capacity, then this is very easy and quick for the local engineers to do (the work will take about 2 hours once the administration is out of the way). You can now connect your LB phones to the wire and you have your own private hot line from point to point. Your system will work even if the local exchange has failed, and of course the line can never be blocked or busy.

Another good reason may be economy. Most companies charge for Private wires on the basis of distance from point to point, a fixed charge per quarter. If you make more than say four calls to a nearby place per day, you may find it much cheaper to install a private wire and LB phones, a sort of 'Hot Line'. You can talk all you want now, it won't cost any more than the fixed cost of renting the line.

6.2.4 PAX and PBX systems

These are private telephone exchanges. A Private Automatic eXchange (PAX) means that you can dial any phone wired up to the exchange, but not make calls to any phone outside of your system. A Private Automatic Branch eXchange (PABX or PBX) gives the same service as a PAX, but in addition also gives access to the PSTN. The advantage of a PBX is convenience. Everyone instinctively knows how to use a phone, so no training is needed for the users. The only major problem is typing out a good directory and keeping it up to date, and the laborious cabling needed.

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This was the eventual solution used in Beirut. Radio systems became hopelessly jammed by poorly disciplined over use of the channels. Private individuals started to install PBXs in their living rooms, then fan out a spider's web of wires to any who wanted service. In time these became connected together more or less informally and eventually became connected to the PSTN by means of radio line extenders. These systems are still the most reliable communication network in the city at the time of my visit (1995) . The comical problem is that users need several phones on their desk, one for the network in each block they might need to communicate with.

You don't have to connect a PBX up to a PSTN line, but if you do then this will give access to PSTN by any phone on the network. If no PSTN lines exist in the area then you have the option of providing one by satellite service, such as Vsat, INMARSAT, or by a radio line extender. This means greater convenience as users can share this resource without going to the terminal, which can then be placed in a good position. Of course this will not improve the reliability of the PSTN line, but perhaps you can 'leap frog' a broken Exchange and connect to a line which is working better this way. HF radio Phone patches can also be arranged, but a radio operator would have to operate the radio, and a special phone patch system needs to be installed on one of the extensions. This is the system adopted on ships, for example.

Against PBXs, they depend on reliable power to the exchange. If your exchange power fails, or the exchange fails, you will lose all of the phones until service is restored. You will also have the same problems as with field telephones, namely that you need to carry out cabling to each and every phone separately. In fact the situation is worse than with Magneto phones because you cannot 'daisy chain' on phone from another. You have to provide a separate line to each phone.

PBXs vary in size and weight. DRCF has a 10 line PAX which is shoe box sized and weighs 5KG, but some designs are quite large and heavy. Older electro-mechanical designs are heavier but use no power at all when on standby, electronic ones use the same power whether idle or in use. It is unusual to find a design intended for portable use. The laboriousness of installation and the non-agility of PBXs means that they are best suited to longer term and shorter range applications rather than fast response disaster communications. It will take about half a day to install 10 lines, and when you move on, it will take half a day to dismantle the system.

6.2.5 Cordless PBXs

Cordless PBXs are like a small scale private Cellular Phone system. In addition to having wired extensions, there are also small, shoe box sized 'base stations' for mounting on the wall inside or your building. The user uses special phones looking like cellular phones. There are many versions of this, such as the international standard Digital European Cordless Telephone (DECT) system. The advantage is that because cabling is much simpler, set up speed is much quicker. Also the users have

the advantage of total freedom within the coverage area of the system. My employers use such a system at our office and I wouldn't go back to being chained to my desk again at any price.

In fact the theoretical range is around 500M, but experience shows that 300M is the best practical range provided base station site is good enough (which is the critical factor). To cover a large area may require the installation of many base stations. One per floor per building is recommended.

Against them is the old problem of getting permission to use the frequencies. The DECT system is unlikely to be affected by another service, it is self-organising, but it would effect another existing service on the same frequency. Also they are more expensive than the wired line alternative, certainly much more expensive than a VHF simplex radio system. If money is no problem, go for this, but if it is then you have a hard task to justify it over 'walkie talkies'.

6.3 'Walkie-Talkies

The term 'Walkie Talkie' is a trademark of the Motorola Corporation. Around the late fifties very physically small valves were devised for fighter aircraft, to the point where a radio transceiver could be fitted into a box small enough to be carried in the hand. This was in contrast to earlier designs which were microwave oven sized, and had another ammo box for the batteries. To make them a bit more user friendly, they cleverly designed them with cups at the ear and mouth position so that they would automatically be used like a telephone handset. They first saw use in the Korean war and then later in the Vietnam war, when 'grunts' would direct helicopter gunships to their positions with them.

Today, as with the term 'Walkman', or 'PC', which are really trademarks, 'Walkie-talkie' has come to mean a hand held two way radio system. This history shows why experts curl their lips up when you say walkie talkie, and prefer one of several alternative names. Englishmen in particular hate to use the term, it sounds like baby talk to their ears and you can see them visibly shudder when they hear the words.

Here are some preferred names that you will hear in conversation to refer to walkie talkies, and an explanation of where they have come from and what they mean.

R/T or R/T set. This stands for Radio Telephone. This term was invented to distinguish this from a Wireless Telegraph (by morse code) in the 1920's, when valves were invented and this made modulation practical. In Regulations and laws, this is still what your set is called. In fact your signals may be called 'emissions by radio telephony' in your licence. Today this term is completely obsolete because of the Public Land Mobile Network (PLMN) better known as the Cellular Phone system or Mobile Phone system. Today the makers of very small cellular phones make their terminals look like telephones and indeed act just like them too. This is to help users to identify with the concept, thus boost sales. You can see there is plenty of scope for confusion with the term Radio Telephone, that is why it is avoided these days (except by legislators).

Two-way radio. To many, the term 'radio' means a wooden box with ornate fretwork standing in a commanding position on grandads dressing table. This is actually a broadcast receiver. The word 'broadcast' is borrowed from a farming technique, where a farmer would sow a field by walking casually around it with a sack of seeds in his hand, and literally throw handfuls at random. This was of course very inefficient and has been replaced by seed drilling. Radio programmes from such organisations as the BBC are figuratively just cast out from the transmitter, to land any which way they will, with no attempt to control the reception at all.

Today, the meaning of Broadcasting in law is that a signal is sent over an area without controlling the receivers. There are special frequencies and laws covering Broadcasting, so be very careful never to say that you are 'Broadcasting' from your station, or the result could be an angry visit from a government inspector wishing to close you down. Two way radio is an unofficial but highly effective term by which laymen will not visualise Broadcasting.

P.R.set, Stands for Personal radio set. This is a Police term because an individual radio is issued to an individual PC for his care (and he is answerable). Many people from a services or Private radio background use this term.

Portable radio. This means it is designed to be used while carried in the hand. In contrast to this term, a **Transportable** radio means one which can be carried from place to place, because it has handles on it and an internal battery, but is designed to be placed on the table when in use. You may wonder why anyone would do that if they had a portable set, but all will be explained later. One thing to watch out for is that in law, there is no distinction between portable and transportable, they both conform to the same regulations. You must take care with some people that they understand the difference between portable and transportable equipment when talking about it.

CB sets, CB stands for Citizen's Band and refers not to a type of radio as such, but to a set of laws and regulations regarding their use. CB sets are technically just like any others, but there are both advantages and disadvantages to their use, which we will discuss later.

Amateur Radio or **HAM Radio**. Again, like CB, this refers to a set of rules and regulations and not to radio equipment as such. However there are some interesting points about Amateur radio that need expanding on, so this is another subject that we will return to.

Handie Talkie or **HT**, A new buzzword used by many manufacturers and much beloved of the buzzword loving amateur radio fraternity. A person using this word probably has an amateur radio background, which is a good thing.

Handset. This really means the part of an ordinary telephone that you hold against your ear. Someone using this word is giving away that he has a background in Telephones,(which is no bad thing). Some radios have 'telephone lookalike' handsets instead of fist mics. This is good because it forces you to hold the mic at the right place, and provides a clear sound right into your ear.

Handheld. Good word.

Whatever its name, nearly everyone has seen or used a handheld. Because of their small size, convenience and ruggedness, they have found nearly universal acceptance by all serious organisations who can justify the expense of them, they are a completely mature product now, and modern designs are more similar than they are different.

6.3.1 Procedures

One off-putting thing about them is that it seems that no one who uses them can resist the urge to speak fluent martian gobbledygook when they pick one up. For some this is all part of the excitement, and knowing your 'rogers' from your 'wilcos' is all part of the rights of passage into the elite world of

the airline pilots and other glamorous folk, but for others it is at best a turn off or at worst very intimidating. I have seen very intelligent and articulate mature professionals reduced to stuttering wrecks for fear of not incanting the right spells to make the thing work.

I want to tell you right now, that in most cases, ordinary language is quite good enough. There are quite elaborate procedures for some services such as Marine radio or Aeronautical service, and they do help a great deal when there is pressure to be clear and concise in the presence of many languages. But if you are not planning to organise much international air sea rescue on your handsets, don't bother.

There are however a few things you should not forget. First, unlike a telephone, it will not ring when someone wants to talk to you, so you must have it switched on all the time, and be listening to the channel all the time to hear if a message is for you. Sounds silly to say this, but we have come across cases where the system was not working because users had their sets turned off, thinking they would ring like a Mobile Phone.

Another point is that for historical reasons, most handhelds use what is called the SIMPLEX system. The technical details are not important but you can always tell a Simplex system because of a button, or bar, on the handset labelled 'PTT' or Press To Talk. You must hold down the PTT all the time you are talking, and remember to let go when you want to listen. Sounds simple but I have spent many frustrating hours with highly educated people before this becomes instinctive. You must say something when you have finished talking so that the other person knows when to talk and when to shut up. Usually this is done by saying 'over' before you let go of the PTT, but anything that makes it clear who should talk next is OK.

Don't forget that the Simplex system is a 'round table' or 'party line' discussion, but for technical reasons which aren't very interesting, only one person at a time can talk. The usual way of fixing this is for the previous speaker to clearly state who should speak next just before he says 'over'. Another way is to have a person called the 'Net Controller' to act like the chairman at a meeting, and decide who the next speaker will be.

By the way, this apparently annoying side effect of simplex, that all stations can hear everything said, is actually a great bonus. If you keep an ear open to what is going on, it is like having a rolling briefing constantly going on. In fact, sometimes someone may just say something to no one in particular just so that everyone can be informed, and understand the whole situation by the time they are called personally for comment. This is one reason why police, fire and ambulance services don't use mobile phones though they could easily afford them.⁶⁶

6.3.2 Callsigns

Just as every car needs a number plate, so every radio has to have a Callsign, for the same reasons of tracking and administration. One example of this is in aircraft. You will see painted on every aeroplane, something like G-AVIR. This is not the number plate of the aircraft but its radio callsign. To avoid confusion if the line is a bit muffled, there is an agreed list of words that stand for each letter of the alphabet, called the international phonetic alphabet. The words had to be carefully chosen so that every race and culture could pronounce them and not get them confused. That is why a pilot of the aircraft just mentioned would call up the tower and say " Woodvale tower this is Golf Alpha Victor India Romeo, taxi clearance".⁶⁷

Why did I mention this when I promised you could use ordinary language? The reason is that some

administrations will issue a licence on the condition that every message starts and end with the callsign that they will decide upon. It will be printed on the licence document. So you may get stuck with "Lima Delta one five zero this is Whiskey Alpha three three five" when you would rather say "Hello Fred this is Bill, over". Your technical expert or administrator will probably tell you what callsigns to use. Having said that, you soon get used to it and I have many friends such as G0FTU, who's name I can not always remember!

You will recall that I said that the other person you wish to call should be listening to his radio. Actually this is not always the case, and he may be holding another conversation or doing something else just with the radio in earshot. You will first have to get the attention of his conscious brain, make his 'ears prick up', by what you say before waffling on with the question you were wanting to ask. The best way is to call his callsign and/or his name twice, then give your callsign and wait for him to call you back. If he doesn't, then try again a few moments later. You may say "Aidman one, aidman one, are you there Brian? this is aidman two, over".

Because you have a virtual party line, you should obviously not call until you have listened long enough to know that there is not already another conversation going on. Simplex is a very unforgiving one-at-a-time system and you will rudely bring the other conversation to a halt (unless of course your business is more urgent, in which case, do explain this by starting with the words 'Priority!, Priority!' or 'Break Break'). While you are talking, unknown to you, there may be other users impatiently hopping from foot to foot saying " get on with it you gas bag", so keep things as to-the-point as possible, and always make it clear when you have finished the conversation by saying something like 'over and out' or 'clearing the channel'.

This is not an instruction manual but I mentioned these points because it shows that you do need to think of training for your users if you expect to get value for money for your handhelds. Encourage your people to try them out, the moment of crisis is too late for them to become familiar with them.

6.3.3 What is the range of them?

This is the favourite question for users and the most dreaded one for the experts, who roll their eyes upward, draw a deep breath and then don't really answer the question at all. To find out why, lets take a closer look at our handheld.

The bulk of the handheld is probably the battery, in a clip at the bottom. Then there is the transceiver itself, with knobs and switches on it. Then sticking out of the top, is a part physically small and unglamorous, but at least as important as the other parts, a 'rubber duck'. This is actually not rubber but a helically wound steel antenna protected by a plastic outer sleeve. It happens that lower frequencies need bigger antennas, so in fact, to make the antenna of a size sensibly proportional to the radio, VHF or UHF frequencies are used in handhelds. Otherwise you would end up with floppy fishing rods which snag on everything and break the radio.

In theory a VHF or UHF radio signal has an infinite range, after all, the astronauts on the moon in 1969 told us of their 'giant leap for mankind' using VHF radios very similar to the handhelds in use today. You are not in space, but on the ground, and if I may make a point, quite close to the ground too, as many users clip the handheld to their belt when not in use. It happens that VHF and UHF don't penetrate through thick walls very well, and not through earth at all. This means that the range is 'line of sight' only.

You know as well as I do that this is not at all true, so what is the explanation of the fact that UHF

radio works so well in built up areas when it should not? VHF radio waves have the property that they bounce off objects they encounter rather well. UHF is even better yet, so this explains why UHF is preferred for handhelds.

Imagine you lived in a chateau where every room was a copy of the hall of mirrors, except that the mirrors were badly tarnished and the windows nearly opaque. You can see that you could communicate from room to room by a flashing lamp very easily, especially in the dark. This is how the world looks to a UHF radio.

Now you can see why defining range is so difficult. You may have a lucky spot at both ends and have a range of tens of kilometres, but you may also get a disappointing few hundred meters. Finding out what the range is, is a matter of trial and error. Every time you change position, you should call up someone else to see if you are in a 'dead spot'. Sometimes just putting the radio to rest on a window shelf is enough to fix the problem, sometimes a more elaborate solution is needed. In any case, regular radio checks are a good idea as you will have no warning when you or the other party does move into a dead spot. Happily there are plenty of tricks for improving this situation and we will now move on to explain them.

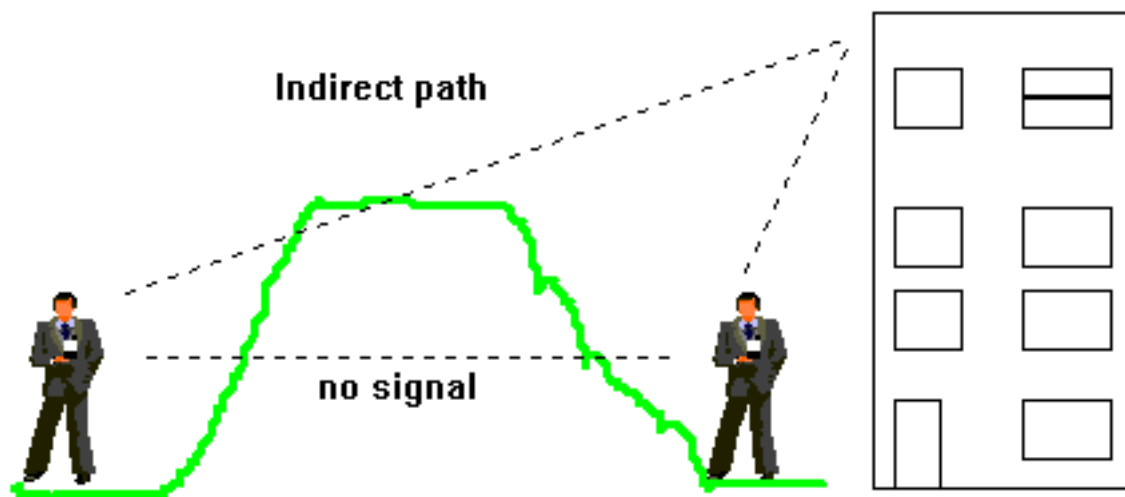


fig 18 Direct paths to handhelds can become blocked, but if you are lucky, an indirect path may also exist

By now you realise that the secret is not in the electronics, rather in the humble but very important antenna. The simplest thing to do is to ask someone to talk for a few moments, say count to 10, then move the radio around until the signal is strongest. This may put the radio in an awkward position for speaking into it, so an extension microphone can be used to make using the radio more convenient.

**VHF radio;
The Secret is in the
position
of the Antenna**

6.3.4 External antennas

If that doesn't work, you can try extending the antenna out of the room altogether. This is only possible where the antenna can be unplugged from the radio, or an extension lead can be plugged in. An extension lead can then be plugged into the socket where the antenna just came out, and the extension lead, (specially made from 50 ohm co-ax cable and fitted with co-ax sockets of the correct type and gender), can be lead out of the room and to the highest point it will reach, (or the point with the clearest view towards the place you want to communicate with). However the extension lead will have some loss of signal, which will get worse as the cable gets longer. In fact the cable should be only about 100m long at the most, unless you use special (more expensive) so called 'Low Loss' cable.

You cannot use the antenna that just came off your radio. You must use a special design intended to work away from the radio. However there are many good designs available 'off the shelf'. Suitable models include, the dipole, the base loaded whip, the ground plane radial, the Slim Jim or the helical counterpoise whip and very many more.

There are as many opinions as there are experts about which is best, but the bottom line is that you are trading size and weight for efficiency. Remember that you have to personally carry this antenna on the 'plane and across rubble for days in order to fix it up, the shop won't deliver it for you. I recommend the lightest, easiest quarter wave whip with helical counterpoise, Ideally, these should be supplied with a large, strong clip, so that they can be quickly clipped onto a pipe or veranda rail, or failing that, they can be taped into a good position or tied with string.

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The St. John Ambulance brigade use this technique at, for example, football grounds, where the metalwork in the frame of the stands make handheld performance very poor despite the very short distances. A small whip antenna with a helical counterpoise is clipped to a position clear of the metalwork, then a length of co-ax cable is led into a first aid post, situated under a metal stand. An ordinary handheld radio is then plugged in to the cable and powered by its own battery. The results are always very satisfactory and the cost is a small fraction of that of building a permanent base station which may be used only a few times a year. With practice, a very satisfactory antenna can be rigged up in about half an hour.

In any event, I can assure you that it is worth the effort, the difference of even modest height is like night and day. The losses in the cable are more than compensated for by the better antenna position. The problem is that you have now sacrificed mobility. You can easily use your ordinary handheld to connect to the external antenna, no problem. There is then no security problem as when the room is left unattended, the radio can be just clipped to someone's belt and carried off. But as it will take a few minutes to fix up the antenna again, you may decide to leave the antenna fixed up in position until the location is no longer needed.

The next obvious logical step is to rig an external antenna system up and leave the radio connected and in the room all the time. This has the advantage that any user has reassurance that the equipment will always be there when needed. However this is only practical where security is assured, or there is usually someone there. However if this is so, then the set-up could be in place long enough to be worth investing some hours in siting the external antenna in a really good spot. What you now have is a **Base Station**, this is a theme to which we will return later.

If you have a really good spot for your antenna, with a good view over the area, then you are really on to something good. Whereas individual handhelds may be out of contact with each other, they could well be in good contact with you at your base station. If there is someone at the base station, then they can write down messages from one handheld, and repeat them to another, overcoming some of the serious limitations with handhelds.

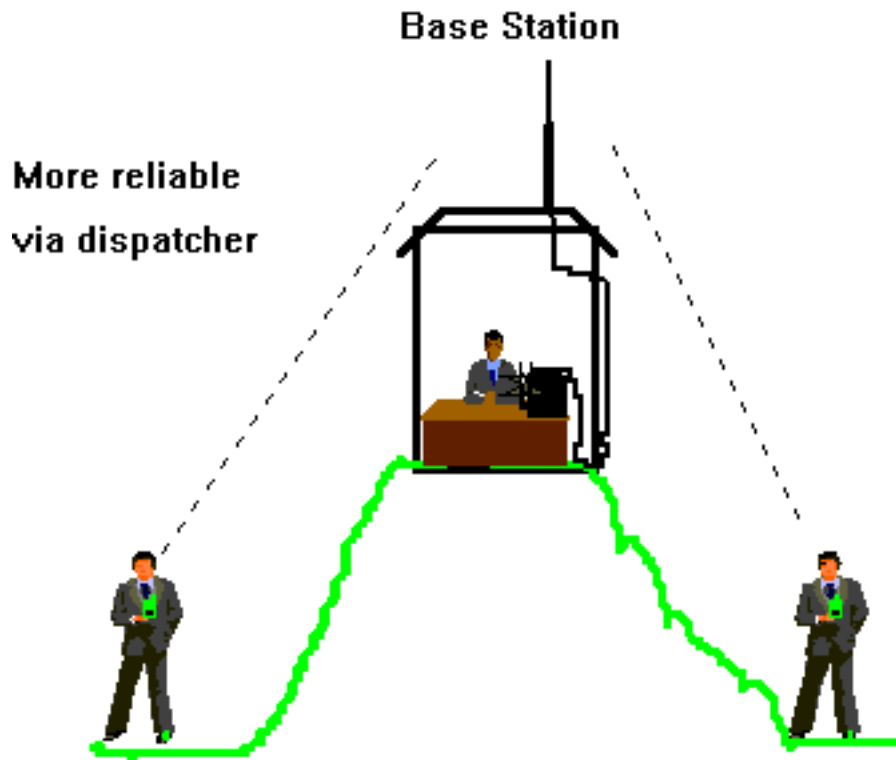


fig 19 If you can install a Base Station in a good position and have reliable manning, this is much better.

I want to stress here that the **secret is in the position of the antenna, mostly its height**, and not the power of the transmitter or anything else. A perfectly ordinary handheld connected to the antenna by an extension lead is just as good a base station as a more elaborate set up. However, there may be justification for something more elaborate and I promise to explain all as we go. I am going to come back to the subject of base stations, but now I think it is time to change subject to that of a Mobile station.

6.4 Mobile Stations

A rather funny name this, as mobile means moving and station means not moving. The reason for this odd name is that the licence for a radio transmitter is called in law a Radiocommunications Station licence, so legally at least you have a mobile radio station. A mobile station means that the equipment is mounted in a vehicle and is designed to be operated while driving and on the move. (or else it should be called Transportable).

I make no apologies for saying again that the **important thing is in the antenna**. Vehicles have the advantage that weight is less critical a problem so a much bigger and heavier antenna can be fitted to a vehicle. The antenna will have a greater 'gain', meaning signals will sound stronger. Furthermore the metal in the vehicle itself helps the whole effect to be even better, but this is only so if you install the antenna in a good position and bond it well to the earth of the vehicle.

A further point is that as vehicles tend to be on the open road and in clear open spaces more than a person is, then the range of line of sight from the antenna is probably going to be much, much more than from a handheld. Whereas a handheld may give 2km range, a mobile can have a 20km range.

You don't have to have a permanently mounted radio in the vehicle to gain these advantages. In the case of an emergency there may not be time to install a mobile radio into the vehicle, or security aspects may go against the whole idea. You can use a so called 'Magmount' antenna. This is a quarter wave or three quarter wave antenna with a powerful magnet on the bottom. The antenna is mounted on the roof of the vehicle and right in the centre of the roof. It is held in position by the magnet, only direct brushing by trees will dislodge it.

The feeder cable can then be let into an open window in the vehicle, and an ordinary handheld can be connected to the magmount. The radio can then be connected to the cigarette lighter of the vehicle to draw power. This then gives the flexibility that you have a charged handheld to use when you get out of the vehicle. You should then disconnect the magmount, locking it up in the car, and connect the rubber duck to the radio for portable use. This arrangement is used by many radio amateurs for example, and is highly effective and secure.

6.5 Power Output

Up to now, I have been saying that power doesn't matter very much, and antennas are the secret, but now I will have to say more about power levels. As mentioned before, handhelds have such poor antenna positions that the range will be limited more by topography than anything else. Even though the signals do bounce as I have said, there is a loss each time this happens, so the signal gets weaker as it bounces each time to reach the other unit. You might think the solution would be to simply raise the power of the transmitter in the handheld, but there is a problem.

About two thirds of the size, and certainly the weight of a handheld is its battery. This needs to be big enough to power the radio until the user can get back to base and recharge the battery. Recharging can take from 4 hours to 16 hours depending on the design of the charger, but usually the battery in a handheld is designed to be used during a working day of about 8 hours, and charged in the rest of the night. If your day is longer than 8 hours then a better alternative is to use batteries that can be unplugged from the bottom of the handheld, and replaced with another one which was charged earlier. (obviously you need to have enough chargers to charge both at night).

Actually if your battery does go flat, you may get no warning of this and be missing vital messages , so in practice it is good to change a battery about half way through the day, during lunch break. This means carrying your spare battery around with you to do this, or arranging a fresh battery for pick up at the place you have lunch.

Handhelds use very little power when just listening on the channel for a call, but very much more when the user talks. Typically, a battery life may be quoted at 8hrs standby time (listening without speaking) or 30 minutes 'talk' time, or sum of the two.

Therefore to make the batteries last longer, they would have to be much bigger and heavier. The irony is that they would soon get bigger than the rest of the whole handheld. There is only one way to reduce battery size, that is to reduce transmitter power.

However we have just seen that a mobile station may have a greater range because of a better antenna, and thus because of that, it will be worthwhile having a higher power transmitter. This in turn will be possible because a vehicle battery has much greater capacity than a handheld one, so the extra current drain is not a problem.

6.6 Transportable units

We need to think of this at our base station. If you think you will ever want to communicate with a mobile station, then you should use a higher power transmitter at the base station, or you may be able to hear the mobile calling you, but the mobile won't be able to hear you replying. This is where your transportable unit comes into its own. Transportables have higher output power than handhelds, so in addition to being larger, they also have larger and heavier batteries. This is why the resulting unit looks so ungainly. In addition, they also often have their battery chargers built in to the unit. This is important because it will prevent the all important charger being forgotten or put on the wrong truck and sent in another direction (which has happened).

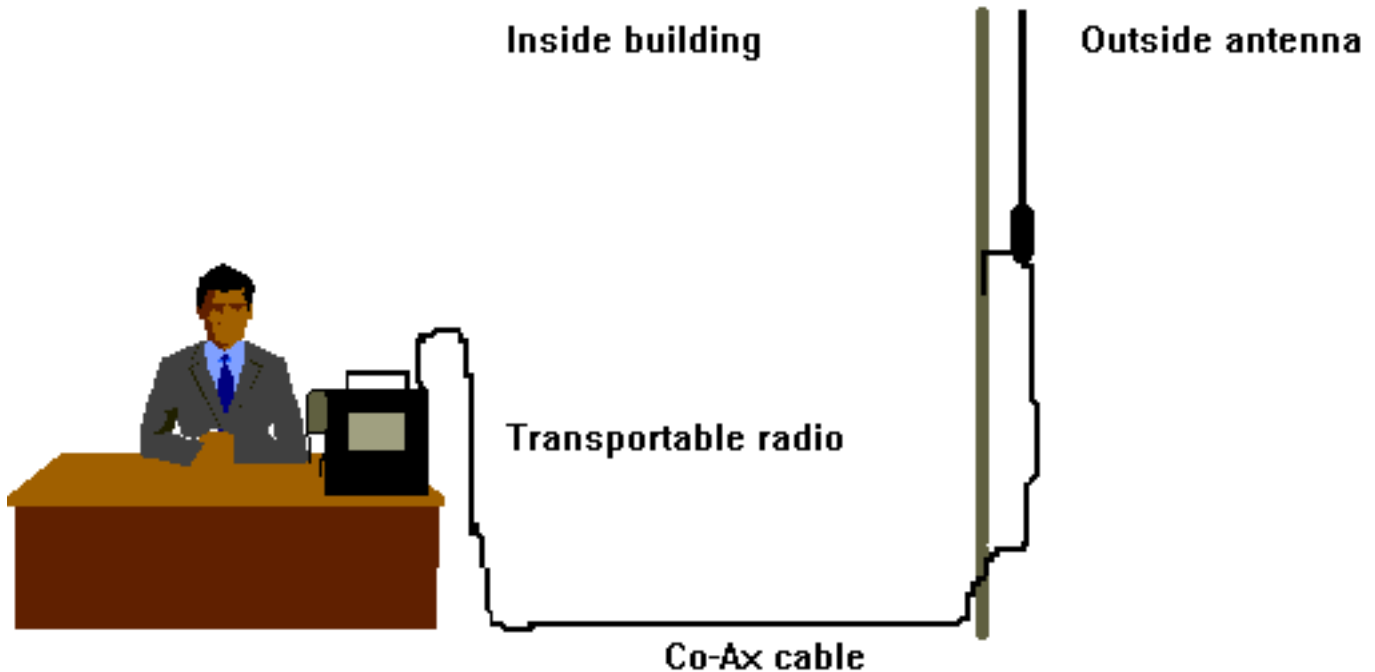


fig 20 A transportable unit should be used with an external antenna.

Transportables usually come with a rubber duck helical antenna built in, intended for use while on the move, but to use this when stationary would be to throw away the advantages of them. You should use a transportable in conjunction with a temporary external antenna, such as one that can be clipped to a fitting in a good position.

6.7 Base Stations

If you are in the happy position of being in a good spot all day, then it will be worth while the hours it will take to put the antenna in a really good spot and even use or improvise a modest mast to improve the height. If you now have such a base station you would be using it frequently to repeat messages for handhelds, so you would perhaps assign someone to permanently keep an ear on the channel at all times. However you may have the problem that the spot which is good for a base station is not ideally where staff would be in attendance at all times, so the site for a base station may turn out to be a compromise between these two factors.

By the way the term **base station** refers to the way you use the site, not to the type of equipment installed there. You do not have to install an imposing panel looking like Heathrow approach radar to make it a base station. You may find that the base station is a rather disappointing sight, a scrawny looking radio rather like the one you have seen in the vehicle that brought you. No matter, it is how it

is used and where it is sited that makes the difference, not what the equipment is.

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The Lebanese Red Cross/Crescent have to provide their own communications for the city of Beirut, which was shattered by the recent war. They have their central control situated in a high spot in the mountains just facing the city, and thus are able to contact both stations in the city and in Lebanon and Syria to relay messages for the Red Cross/Crescent. They also pass personal messages of a humanitarian nature from members of the public who hopefully submit desperate notes in handwriting. (there is nothing else in most villages but the Red Cross/Crescent radio). Impressed by how well this was working I visited the base station, to find a small team of very enthusiastic young volunteers, men and women, Christian and Muslim, bent over a homely, improvised table with a dozen very ordinary VHF 'mobile type' radios (apparently) haphazardly jumbled about. Hand written notes in Arabic were being passed from one person to another with speed and relayed on. They were a little embarrassed at the 'informal' technology, but I assured them that they were doing much better than some well equipped radio rooms I have seen, because of how they were using their equipment rather than how expensive it was. By the way, today they do have a splendid hi-tech control room, but I hope the superb morale of the Lebanese Red Cross/Crescent communications department is not changed.

One solution to the problem of having to have the Base Station in an inconvenient position is a 'remote controlled' Base station. In this arrangement, the base station itself is placed in a position which is best for the antenna system. While the controls are placed at a position where you can expect staff to be present. This is done by using specially made basestations which can be remotely controlled. There then has to be a cable from the basestation to the remote controller. In most designs, ordinary telephone cable can be used, then temporary cabling rather like that used in field telephones can be rigged, enabling the placing of the base station on the top floor of an adjacent building, while the controller is in the office, perhaps at street or basement level.

For a more permanent arrangement, a private wire can be arranged from the local telephone administration, connecting the two points. This will however cost you a installation fee plus a quarterly fee for the maintenance of the line. This is the method used by HM⁶⁸ Coastguard and the Air traffic control authorities among others. This explains their fantastically long reach as they select towers on top of high hills for their basestations, while the air traffic controllers headphones are connected to them by telephone lines (private wires).

If a private wire is not practical, or there are not staff at any location to handle traffic, then another alternative can be tried. The repeater.

6.8 Automatic repeaters

Usually called simply Repeaters or sometimes Relay Stations, these automatically repeat messages just as the radio operator would do at the base station, (if he were not having a break). Naturally it does not do it by writing the messages down and speaking them out but another way.

The receiver at the repeater receives the incoming message as usual, but instead of putting the voice out on a loudspeaker, the output is connected straight into the 'microphone' socket of the transmitter. The receiver has circuits to detect when someone is talking, and switches on its transmitter, boosting the signal and putting it out of its own transmit antenna, (which is obviously in the best position you can possibly find). The other handhelds receive this strong signal from the repeater transmitter, and so

hear loud and clear signals from the sending handheld, giving the impression that the handheld itself has a greater range. This is the system used by for example police forces, which explains why their handhelds seem to have such a good range.

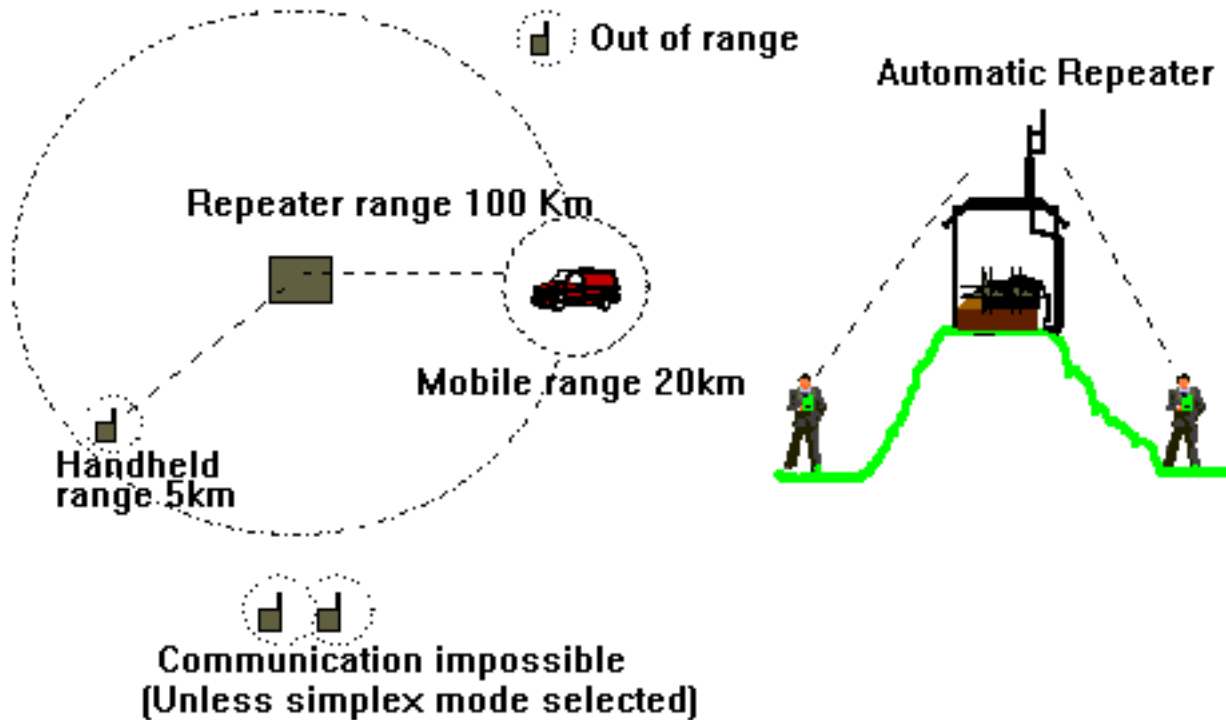


Fig 21 Repeaters boost range but need fallback schemes in case of failure

However there are some snags with repeaters. For technical reasons that I will have to explain later, if you set your radios to work with repeaters, they then cannot work without them. Therefore if your repeater is not working either because of a fault, loss of power, it has been stolen, or it never seems to have made the right truck somewhere, all of your radios will not work until you fix your repeater.

Also, if your handhelds stray out of the area of coverage of the repeater, say by driving to another town on the other side of a hill, they will not work with each other, which will confuse the users no end. If you choose to use repeaters you must guard them with zeal. Someone will have to check them to change the batteries or top up the fuel in the generator at least every 8 hours. You have just put all your eggs in one basket, so you must take extra care with the repeater.⁶⁹

Because of the vulnerability of repeaters, you will need to have a fall back strategy, but in order to understand the problems and solutions with them, I will have to get more technical about channels.

6.9 Channels

Probably somewhere on your handheld or transceiver there will be a control marked CH or Channel. Typically it will have some positions marked A-B or 1-6. It may seem that contacting another radio would be as simple as just selecting the right channel, unfortunately this is not so and there are many complications. To examine them let's just take a short step back and look at how radio works.

In the days before radio, carrier pigeons were used to carry messages. When the pigeon arrived at the destination, it was ignored. The important thing was the message strapped to its leg. When radio first came in, the term carrier wave was often used as an analogy with the pigeons. The carrier wave transports the message to the receiver, where the carrier wave is discarded and the message is extracted and read.

However, here the analogy ends. For one of the useful things about radio, is that the carrier can be at various frequencies. A part of the transmitter will set the frequency of the carrier before the message is put on, by a process called Modulation, in another unit called the Modulator. In the receiver at the other end, a special part of the receiver called the Tuner, can let in only the frequency wanted by the operator. The allowed in carrier then has the message removed by a unit which does the opposite to the Modulator, called the Demodulator.

If we set the tuner of the receiver to the same frequency as the carrier at the transmitter, and if we use the same type of demodulator as the transmitter had modulator, then the radio link will work. Actually there is only one modulation system commonly used in handhels today, the FM system (12.5khz separation or 25khz separation) so you would be unlucky to have a modulation system mismatch. Frequency is another thing.

Apart from some exceptions which I promise to come back to later, you will likely have applied to the host government in the country you are operating in for a (PMR) or (Private Mobile Radio Licence). You will then be allocated a frequency by the government, rather than your choice. You may be lucky enough to have permission for more than one frequency, but again, they will be set by the government. To stop people illegally using frequencies for which they do not have a licence, most governments forbid the use of radios in which the user can select any frequency, but rather, specify channellised equipment.

Prior to the introduction of Synthesizers, a crystal would be fitted into the radio, one for each frequency used, by a technician in a workshop. Today this is done by computer or diode programming, but it means that the user can not select the frequency directly, only select the ones fitted into his radio. There are several problems with this.

One problem is that if your radios were programmed by different technicians, they may have been programmed in a different order to other sets. Therefore the frequency on channel 1 for one set, may be channel 3 on another, and channel D on another. Never assume different handhels will work together until you have checked every channel. If they don't work, don't assume that they are not programmed, but test all channels until you know which are which. The best thing is not to let this happen to you by carefully controlling who programmes your radios and having some kind of plan to standardise things. If you have the luxury of having the frequencies written on a plate on the back of the radio, this is better, but some organisations insist that the actual frequencies be kept secret.

If you are working with a different organisation, then very likely their sets will be on different frequencies to yours. There is no point in saying, call me on channel two, because their channel two may be a different frequency to yours. On the other hand, if you are going to be working with another organisation a lot, you will have to tell them the frequency of your channels so that their engineer can programme their sets accordingly.

You would then need to arrange that the common frequency appears on the same position of channel knob in the sets of both organisations, as people are sure to say, 'call me on channel 2' rather than '165.475MHz'. Interworking is not always possible. Sometimes regulations or jealousy prevent this information from becoming available so you will need to check that this is OK before doing it. Sometimes the technical details of the radios do not make it possible, for example if one organisation has VHF and one has UHF.

There is a further complication regarding repeaters. Remember I said that the repeater listens to a handheld then transmits it out by its own transmitter. But this should be impossible because the receiver would then become jammed by its own transmitter, and never hear another word from the

handheld. Quite true, so a tricky trick is used. The transmitter puts the signal out on a different frequency to the one the receiver is tuned to. This is called the Duplex system.

The upshot is that the handhelds have to know to listen to the output frequency, but when the PTT button is pressed, re-tune to the repeater input frequency. Because the repeaters antennas are usually higher than the handhelds, the repeater output frequency, or handheld input is called the downlink. The handheld output frequency which is the repeater input is called the uplink. It would be too much to expect operators to remember all of this, so the channel selector knob is programmed to arrange this automatically when you select a certain channel number. So you can see that **some channels are two frequencies!**

The bad news is that if the repeater were faulty, or not put up yet, then the handhelds would not hear each other because they would not be set to listen to the transmit frequency of each other. There are two solutions to this problem. The best one is to apply for a simplex frequency in addition to your duplex pair. This means that you manage without a repeater if you didn't have one by simply changing to the other channel. The problem is that everyone would have to know this and change accordingly.

Another idea is to programme one of the channels to the output frequency of the repeater, but arrange simplex programming on that channel. This could cause confusion because someone would be sure to hear the repeater when flicking channel knob, then wonder why no one could hear him when he calls. If you have only one licence for one duplex channel, but have two channel radios, then programme simplex mode on the downlink frequency. This has the advantage that users can be warned to switch to the other channel when the repeater's failure is learned of, because they will still be listening to the downlink frequency in receive mode.

Again, you would need to explain what you had done to your users, so some form of instruction is needed or your investment will be wasted.

A further complication is that the government may not allocate a duplex channel to you, in which case you cannot use a repeater. In that case, you have the option of a remote base station arrangement. Remote basestations also offer the advantage that if they fail, handhelds that are in range can still talk to each other, and to mobiles or transportables, so the problems of working in failure mode are less severe.

6.9.1 Trunked repeater systems

Another problem with repeaters is that a handheld could quite easily stray out of the area of coverage of the repeater. If the area of operation is larger than the area of coverage of the repeater, then another repeater will have to be built on a site suitable for coverage of the new area. There are two problems with this, firstly the users will have to know what the coverage areas of the respective repeaters are and they will have to know of and have their radios programmed with the frequency for the other repeater. The other problem is that it is not possible to communicate with users on the other repeater.

One solution to this problem is to couple or link the two repeaters together, either by a landline link or by a radio link.

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The USA Radio Amateur Civil Emergency Service (RACES) have the privilege to do this. Upon a command tone from a handheld station, the amateur radio service repeaters will pick up and relay anything that the other one(s) in the same

group can hear. This results in the coverage of the handhells becoming region wide. -RACES

To overcome the problem of users having to keep re-tuning the radios, more ambitious trunked radio systems are in use. With these, the radio automatically scans for the strongest signal and re-tunes to it. This does mean that the radio has to have the appropriate control systems built in, and it has to be correctly programmed.

In multi-channel 'pool' systems, each repeater station has not just one channel, but several channels available for use. The same repeater can then be used by different unrelated services, all of whom benefit from the repeater's coverage. When a user presses the push to talk button on the handset, a short data message is sent from the handset requesting an uplink channel to the repeater. If there are no spare channels available at the repeater, then the user hears a low pitch 'boop' sound, followed by a 'pip-pip-pip' sound when a channel has become free and been allocated. When the 'pip-pip-pip' has been heard, the user can now speak.

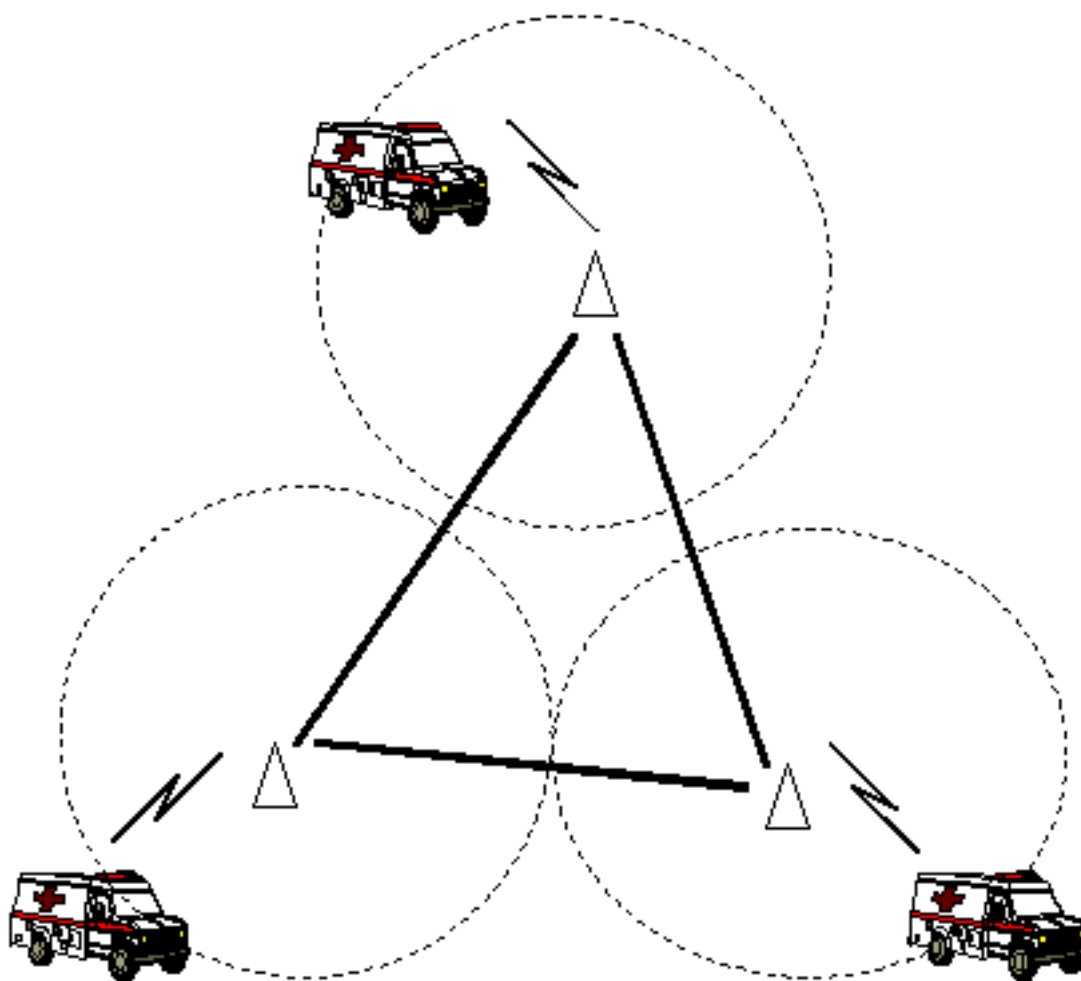


fig 22 A trunked system links repeaters together to provide a wider area of coverage while keeping operation of the radio as simple as a simplex system. This method also retains the benefits of point to multipoint communications.

In the mean time, all the other handsets which are programmed to be in the same group as the sending handset will have been 'paged' by the system, and will have tuned in to a downlink frequency on the repeater who's service area they happen to be in.

More advanced versions such as the Ericsson/GE EDACS system are digitally scrambled, making unauthorised overhearing, by journalists for example, impossible. EDACS also offers the possibility for a handset to 'join' and 'unjoin' groups as the needs requires. For example, a Red Cross unit would

be only in the Red Cross group normally, but once on the scene, may decide to join the same group as the local fire/police/medical services are on in order to co-ordinate their efforts better.

The advantage of this is that there is virtually no limit to the size of the area that can be served by such a system, while there is no knob twiddling to be done by the user and so it feels just like a simplex walkie-talkie to him.

The disadvantage is that 'ordinary' radios will not work with a trunked system unless they are specially programmed to do so. This means in fact that you have to be given radios by the operators of the trunked network. This could present a problem as they are quite expensive and so it is unlikely that there will be many floating spares at very short notice.

Also, the system needs to be set up by engineers and so is unsuitable for use in the first phase of a disaster. However it is ideal for the case where regional planning policy provides for such a system for the local emergency services, for instance. If you are planning ahead for disaster communications in a known area, try to get permission to use the local administration's trunked network and obtain handsets and mobiles on their system.

6.10 CB

Citizens band as it is called in the USA, UK and other countries, refers to a band of frequencies which have special rules. Any private citizen is free to go to the Post Office and purchase a CB licence, renewable annually, entitling him to set up a radio transmitter provided it conforms to certain rules. So far, this is really not different to anything else mentioned above. The result is that there is such a large mass market for sets which conform to these rules, that the prices of the transceivers on these bands tends to be about one quarter of that for any other band. If cost is your priority, then this may be for you. However there are some things that you need to be aware of.

For one thing, not all countries have a band allocated to citizens personal radiocommunications, so it could be illegal to use them. Some countries have their CB frequency band on a different frequency to the 27MHz used in the UK and the USA, so the price advantage may be lost as cheaper equipment will not work. Additionally, the USA specifies AM modulation whereas the UK specifies FM.

Another problem is the frequency itself. 27MHz is a frequency with big problems. Most of the time it acts like VHF, as a purely line of sight mode, but not bouncing off walls of buildings very well, reducing its effectiveness in built up environment. However it does perform well at rolling over gentle and smooth terrain. The problem is that due to the influence of the sun, every 11 years it becomes liable to long distance 'skip' causing its signals to bounce off the Ionosphere and giving the band fantastic ranges. Well what is wrong with that, you ask quite rightly? The problem is that now you will have strong interference from USA and S America which will make the channels hard to use for local messages as they will be swamped by strong signals from excited (and illegal) high power stations.

A further problem is to do with the wavelength of 27MHz. It is about 11 meters long, as opposed to about 70cm for UHF. This apparently boring detail has a profound effect on antenna size. For example external antennas have to be about 5 meters long, making them much larger heavier and more expensive than the titchy UHF equivalents. The biggest effects though are on the handhelds. A whip on a handheld would have to be at least 2.5m long, like a fishing rod, in order to be efficient. Even if you try helicals, the sizes become like horse whips and are not really handy.

By far the biggest problem is the popular success of the band. Many thousands of ordinary people, and in particular young operators having their first taste of communications technology are on the CB. As they are not required to pass an exam in procedures, this means that discipline on the band is notoriously bad.

To add to that, many CB users feel that their band should be used only for personal use, and greatly resent the use of the band for 'serious' use. You can see why; commercial users would block it all day with traffic that should really be sent on the proper commercial frequencies set aside for that purpose. Therefore you may find yourself subject to hostile 'jamming', and a great deal of intimidation designed to make you move over to a proper commercial frequency.

On the other hand, if you are operating in an area where a disaster is in progress, CB users are unlikely to feel that way, and on the contrary, you may find many useful local contacts who are in a position to be of help to you. Nearly all countries supporting CB have disaster relief networks such as 'React' to help you in this way.

Whether legal or not, you may find that the CB band is the only one which is common to all agencies working in some areas. We saw before that interworking between agencies can be fraught with technical difficulties, but you may have CB in common with them, in which case the channels are the same frequencies for both organisations. Unfortunately, repeaters are forbidden on the band as duplex working is not allowed.

CB equipment is so relatively cheap that it is not a bad idea to pack at least one transportable with external antenna, and perhaps a handheld too, just in case it comes in handy. If it doesn't, you can always use it for shopping trips.

6.11 Amateur Radio

Amateur radio, (or Ham radio) is another set of international laws enabling private individuals to operate radio stations for their own self training and entertainment(see part 1, 3.4) In this respect it is like CB. But there are also many differences, many of which are very important to know, so without giving an exhaustive lecture about amateur radio, let's look at some of the more important points.

Let me return to the theme of handheld radios again. You will recall that some of the problems with CB are associated with the large antennas and liability to jamming. Amateur radio does not suffer from these problems because there are many frequency bands allocated to amateur use, one of which is in the VHF band and one in the UHF band, both of which are ideal for handheld units.

Amateurs are required to sit an exam before being allowed to take to the air, and are required to keep good behaviour or they risk losing their licence. All of which adds to greater discipline on the amateur radio bands. A further plus is that repeaters are allowed on these bands, and furthermore, a large network of them already exists.

Local amateurs are probably well drilled in the arts you need for communicating in the local area. They will understand the local topology, for example, and already know what is possible and how. They will also know about the coverage of the local repeater system and packet nodes. Even if you decide to deploy your own system, Amateurs can advise you about what to deploy where and even be able to help you with some of the hardware you may need. Best of all, it won't cost you anything!

Another advantage is that the Amateur radio bands are defined by international law, so you will have a common pool of agreed frequencies to use for interworking with other organisations. This has the advantage that there will be no need to wait for a frequency to be allocated to you, you could start to use the channels immediately.

With all these plus points, you may wonder why everyone does not use the amateur bands. The reason is that in law it is strictly forbidden for any person who does not have an Amateur radio licence to operate on the band. So you would need to either take a Radio Amateur with you, or get the users to obtain their own licences.

In practice the situation is much better. The International Telecommunications Union (ITU) is very well aware of the practical problems faced by disaster and aid organisations in moments of crisis, and are also well aware of the benefits that radio can bring. In Resolution 640 (see 5.2), radio amateurs are encouraged to 'meet the needs of international disaster communications'. There is a full consideration of all this in chapter 5, but here is a brief summary.

The British regulations, for example, say that a licensee can allow a 'representative of a user service organisation' to use his equipment, but only under his 'presence and direct supervision'. As to what is the definition of a 'User service organisation' and what constitutes 'direct supervision' depends of the interpretation of the rules by the government in who's territory you are working.

In the case of breakdown of authority in the area concerned, this may provide you with a way of circumventing red tape and getting equipment into the area as you won't be intruding on any existing users frequency. This fact alone may be enough to allay fears from existing users, and create less barriers to get you on the air as soon as possible. Invoking resolution 640 provides you with a legal framework for operating, which will keep you out of trouble, provided you obey the locally applicable regulations but you must demonstrate absolute maturity in how you exercise the privilege so provided.

It would be illegal to use the Amateur bands for an extended period for a long term aid operation. Another point is that you have absolutely no right to hog any channel, or to cause interference to any other Amateur operator. Whatever the case, finding someone in your organisation or team with the will to obtain an Amateur licence is obviously no bad thing.

There are however security implications in using the Amateur service, I have covered this before in part 1, but I thought this a good time to repeat it again. The Amateur Radio Operators working with you are unlikely to embarrass you, but many others will be listening in with great interest. It will be like doing your laundry in the town square, with passing strangers looking on. Ideally you would like to solve this problem by using data systems such as packet radio, in which case you would want to scramble the data before sending. The problem is that it is strictly forbidden for an Amateur station to send messages in anything other than 'plain language'.

By contrast, your organisation rule book may insist that you preserve the confidentiality of those you are serving, making passing such information in such a public forum out of the question. This issue means that the use of Amateur radio may be limited to logistical matters, but in any case this will depend on what the policy of your organisation, the policy of the host nation regarding sending coded messages by amateurs, and how urgent your need is.

A further problem is that amateur networks are designed to relay written messages from net to net until they arrive at their destination. It takes quite some minutes for even a simple message to be spoken over the air, written down, checked, and spoken again to the next net controller etc. until the message arrives at the addressee. If this requires, for example, four repetitions of the message, then it

can take 20-30 minutes to ask a question and get a reply. Again, packet operation improves this situation.

6.12 HF Radio

Whatever we do, the range of VHF and UHF radio systems will be about 50-100km at best, so what if we either don't have a high spot to rig our antennas, or the range to the next base is more than the range of our equipment?. One answer is HF Radio.

There is another better book dealing with the setting up of HF radio stations for aid organisations, "**Where There Is No Telephone**", (see bibliography) so I will not repeat the fine work covered in its material. However, while you are waiting to get your copy, I will go over some of the main points.

For a fuller discussion of how HF radio works, see the **Appendix " How HF Radio Works"**. Basically we need to remember that we are reflecting our signals off the underside of the ionosphere, our marvellous shield, protecting us from radiation in space and making life on earth possible. However the shield is built to keep radiation out, not radio in. It is different under the day part where the sun is stronger and the shield is higher and more active, than it is under the night time part where it is lower. As we rotate under it, the frequencies that will work well by day will not work well by night.

The bottom line is that you will need to have at least two frequencies or more, (at least 2MHz apart), to give reliable HF radio contacts. It then depends on the skill of the operators to decide which frequency to use, but it is always better to use the higher one by day and the lower one by night. The best thing would be if we could get our experts to predict the best frequencies for us, and then apply for licences at frequencies near to the best ones selected by our experts.

6.13 Allocations

The sad fact is that this will not be the case. We will have to apply for a licence for a frequency from the government of that country, but we will be just one of many applicants. The result will be that we will be stuck using the frequencies that the government issues. Therefore we may find that our frequency is only any good at certain times of day, leaving us cut off the rest of the day. If this is so, it is important to carry our regular radio checks with the other stations in our organisations to see that they are still in contact with us. Over a period of a year, the pattern will emerge of how our network is performing.

Further bad news is that your licence may insist that you share the frequency with other users, and specify a time for you to use the frequency. If you are in a skip zone (dead zone) at that time, you are out of luck, and should re-apply to the government explaining your problem.

Whereas with VHF, the secret is the height of the antenna, in HF radio, **the secret is in the frequency you use**. You should get expert opinion about what frequency band to apply for.

HF radio:

The secret is in the frequency

Once the licences are issued and their terms and conditions are known, only then should the equipment be ordered and purchased. The licence may specify certain technical restrictions on the radios and antennas to be used, so you should get an expert to look over the details for you before you purchase to make sure that the equipment will meet 'type approval'. Type approval varies from county to country, and is different from Europe to Africa for example. Pester your salesman until you are quite happy that the equipment meets the type approval for the country in which it will be used , there are lots of bad stories about this.

See 3.1.3

The type of antenna you buy will depend upon the frequency you are intending to use, the physical space that you have to erect it and the range and direction of the other station or stations you are intending to call.

There is more information on this in "Where There Is No Telephone" and in part 1 CH 3.1.3 of this book, but here is a summary of the main points.

Once the frequency has been decided upon (by the host government) you now must specify this to the supplier of the antenna. If you have been allocated more than one frequency, then it is possible to have the same antenna designed to work with several frequencies, in which case you must specify this to your antenna suppliers.

Another alternative is to use Broadband antennas, or Long Wire antennas with an automatic or manual Antenna Tuning Unit.(ATU). Or you can use temporary 'bobbin type' antennas which are physically wound out to the right size when the frequency is chosen. This is better for those on the move as it is very compact.

In any case you may end up with an antenna which is physically about 50M long, so you may have to take this into account when selecting antenna type.

If you are communicating to another place, the direction of which is known, then a beam is better, concentrating your power in that direction. If you are working mobile stations then an 'inverted V' might be better, offering both vertical and horizontal polarisation.

Good installation of HF antennas is very important, especially with respect to their height, bearing and earthing. Make sure that whoever installs the antenna has the instruction manuals from the maker and has access to advice about the installation of it.

The choice of make and model of radio is much less important than the frequency and the antenna, but you should choose something that your people can understand, and has a reputation for reliability and prompt maintenance in your area and is type approved in the country you are working in. One way of simplifying things is to buy locally.

6.14.1 Scanners

If you have been allocated more than one frequency, then a scanner, allowing you to listen to the frequencies one at a

time, at say one second intervals, is a very good idea. Then if callers don't get through on the higher frequency, they might try the lower one. The problem is that if you don't know that the higher one has faded out, you may be listening to a dead band without knowing it.

Scanning receivers can be programmed to switch from frequency to frequency so that you can listen on all the frequencies that you may be called on.

Naturally this means that the calling person needs to make a call at least 15 seconds long in order for the scanner to visit that frequency and open the speaker long enough for the person to recognise his callsign. Separate scanners have to be connected in such a way that they will be disconnected from the transceiver when transmit is selected, by connection to an external RX antenna socket on the back of the

transceiver.

A much better way is to specify a transceiver which is capable of scanning by itself, not all models offer this but it is highly recommended.

6.15 HF Amateur Radio

The Amateur service can be used in a disaster, provided the Host government has given its permission. By invoking ITU Resolution 640 and the Tampere convention, you can use the HF radio bands allocated to the Amateur service (see ch 5). This will also solve the problem of interworking with other groups in the area. Amateur bands in the 3.5, 7 and 10 MHZ band are all excellent for local contacts, but as usual you must organise who listens to what frequency and when.

Amateur radio transceivers can be

purchased which can also be used in a general coverage mode and thus be used both on amateur and commercial frequencies. This will enable the same radio to be used for local calls and for long distance phone calls via a coast station such as Portishead Radio.

Another important point is that Amateur bands are not restricted to just voice communications. Other more advanced data communication modes are very common, indeed were developed on the Amateur bands. To see why you would want to get an already complicated situation even more complicated. Let's look at them on the next section.

6.16 Data by radio

There are many radio data systems, but by far the most common in 1996 are:

- Packet**

● Tor

Before we look at them, we must ask, why spend time and money on them when we can make do with something simpler? Perfectly good question. Technical whizz kids just love gadgets, so they are likely to insist on their indispensability sometimes for reasons less than logical. Data communications systems will cost you more to purchase. Not only because you will need special, (but not too expensive) extra circuits, but because you will need a computer or terminal to process the data.

Now, I have used computers every day for many years, in fact the whole of this document was written on various lap top computers. I would never be without one on my travels around the world, but I still can't decide weather I love them or hate them. A fixed desk

top computer connected to the mains is one thing, but when you start to travel with a computer it is quite another. Is it robust enough to handle the bad knocks?, did you remember to charge it? Where is the charger? Yes, computers are not totally reliable yet. If your PC won't do the business for any one of a hundred reasons, you will have egg all over your very red face Trust me, I know.

Never trust techno-wizzgadgets. If you are really serious about reliable communications, then always have a back up plan, preferably a simpler system, to fall back upon if your flagship sinks. For example you may arrange a voice check on the link say two or three times a day at a scheduled time convenient to both operators. If the data system has failed, you will learn of this at the 'sked' and be passed any

missing traffic.

Now that I have said that, I still think that Data communications systems are a very good idea, why? Because if they can be connected to a regular radio, and if they are working, good. If not, then you have not lost anything provided you take the kind of precautions just mentioned.

6.16.1 The problem

=REPORT=REPORT=

In one recent case, a DRCF engineer was sent on a very dangerous journey through a civil war zone with a mission to find out why a Humanitarian aid communication system was not working. The problem?, nothing wrong with the equipment, but people were too busy to sit near to the radio all day, so very often callers would call the station while no one was there. Hearing no answer they assumed that there was a technical problem, and having lost faith in the system, stopped using it.

Wouldn't it be nice if you could just write out a message for the station at the other end at a printer on their desk, or in their car. Then they could read it when they had time, a kind of do-it-yourself Internet. Of course you would want something that told you if

the message got through or not, but think, you could write your message and get on with your very important work instead of wasting time with knobs, dials and roger-wilcos.

You may smile and sigh at this fanciful dream from the far future but don't. Its here now, it definitely works, and its relatively cheap.

6.16.2 Packet Radio

The Packet radio system (I will discuss AX25) is most suitable for VHF and UHF systems. It gets its name because of the way it converts your data into 'packets' with an address on the outside and the contents on the inside. You connect a small box called a Terminal Node Controller (TNC) to your ordinary radio's microphone and headphone socket, you don't even have to open up the radio. Then you connect either a

computer or a 'terminal' to the box. Terminals can take the form of a small thermal printer with a keyboard attached, such as the famous TI703, or some portable electric typewriters can be adapted for this job.

To use the system you just type "connect station 1", for example into the keyboard. Then it writes " connected to station 1". From then on anything you type comes out at the other end on the screen or paper, perfectly simple. If the other person is there at the time, you can even hold a two way conversation. At the end of the message you type "disconnect" and it replies "disconnected". There are many advantages to having messages in text, and we have covered them in chapter 1.2.3 , so if you have not read that, please do so now.

You may wonder what if the station is

out of range of your VHF set. Normally, if you do not have a repeater, you would be out of luck, but packet radio has another very pleasant surprise up it's sleeve.

6.16.3 Digipeating

TNC's talents don't end at just connecting as in our first example. They can also take in messages and then pass them on to someone else who is in range of it, but out of range of the sender. This is called Digipeating (digital repeating). Any or all stations can be digipeaters. You can pass messages over thousands of miles, if you know the routing to send it.

AX25 needs the sender to type in the route like this `Connect station 1 via station 5`, then all is the same. However some more intelligent systems can work out the routing for themselves. If

you are using digipeaters which are usually in the same position, and which are normally switched on, then digipeating is ok, but otherwise some other ideas are worth looking in to.

6.16.4 Mailboxes

Suppose my equipment is out of range of the sender or the other station is not always switched on, or I am a mobile station and my route via the digipeaters is different from the usual, then I won't get anything, so what now? The most common fix is to designate one of the stations to be a mailbox. This will have to be one which has a good power supply as a computer will now have to be on all the time to act as a mail server, in other words be running a special programme and preferably one which is in a position of good radio coverage.

To send a message to the mailbox is

also simple, the sender types " send station6 at mailbox1 " instead of the usual command. To retrieve messages, you just connect to the mailbox via the digipeaters as usual, then after typing in a password, you can privately read your mail.

There are many exciting ways of using packet radio, but this is not an exhaustive manual on all modes so time to ask another question. What if you are out of range of any VHF working digipeaters? There are two methods, satellite systems, and the HF radio equivalent of packet, TOR.

6.17 Satellite Packet Radio

This system, called 'Satellife' (see appendix) was invented especially for aid organisations by volunteer communications experts at Volunteers in Technical Assistance (VITA). A packet radio Digipeater/mailbox is built

aboard a Low Earth Orbiting Satellite (LEO). The satellite passes low over the earth about four times per day. You type your message into your TNC, then it waits until the satellite passes over next time, and beams the message up. At the same time, messages become beamed down by the satellite. It is rather like a global roving mailman.

The plus side to this is that not only is the equipment very inexpensive to purchase, but the service is free. The system has access to Internet in order to traffic messages to users not so equipped. There are more details about this in the appendix.

6.18 Teleprinter Over Radio (TOR)

Teleprinter Over Radio (TOR) can also be known as Simplex Teleprinter over Radio (SITOR) or Amateur Microprocessor Teledata over Radio (AMTOR). They are more similar than

they are different.

In most ways, TOR is used just like packet radio is, but there are some differences also.

There are in fact packet radio systems that work over HF radio. These have the advantage that they can send the full ASCII character set, making it possible to send messages generated by computer mail programmes. However straight packet is much less reliable over HF radio and so a special version called PAKTOR has been developed and I will come to that later. For now we will stick to TOR.

TOR is used in a way very similar to packet. The user first types into the keyboard the receiving station's selective callsign, then waits for a 'connected' indication from the

terminal. From then on, you can type out information that is guaranteed to arrive just as you typed it, on the other station's screen or paper. This is achieved automatically, by sending the letters you typed three at a time, and then checking that they are OK at the other end. If they are not, then they are repeated until they are correct. All this is done automatically so there is no need for the users to know about any of this. A big plus is that it can work even if the equipment is un-attended, thus freeing people for more important jobs. Tor is very mature now and is used by such organisations as the CICR(Comitee International Red Cross). There are also mailboxes available for TOR just as there are for packet.

The disadvantage of TOR is that for reasons of history, it can only transmit letters of the alphabet, numbers and a

few punctuation symbols. You can therefore not transfer ASCII coded computer data over it directly, but of course programmes exist for filtering out unsupported characters, if you do write the message on a computer and forget.

6.18.1 Pactor

The Pactor system is a highly successful development from the TOR systems just mentioned. It took the best of the TOR and Packet systems and combined them into one. It was invented by a group of German radio amateurs who wanted to exchange computer data files and found the limited character set of AMTOR too restrictive for their liking. There are three big advantages of Pactor.

1) It can transmit the whole ASCII character set, in other words upper case and lower case letters, and can

transmit all of the symbols appearing on your computer keyboard. At first this may seem like only a small victory, but it means that pactor can carry files generated by electronic mailing systems, for example. Another less obvious advantage is that it can transmit computer files which are not messages at all, such as spreadsheets, or even programs themselves.

2) It transfers data much faster than TOR, four times faster, at a rate of 200 Bauds for Pactor as against 50 for TOR. there is also a version transferring data at 800 Bauds. (However this is still reletively slow compared with PSTN line and modem).

3) More advanced error correction systems are used so that the chances of the message arriving without corruption, even over a bad circuit, are better.

The Humanitarian aid community soon showed interest in this mode and a special version was developed for them, known as Swiss-PTC (Pactor Controller). It was a big hit and generated high demand for traffic. It is not exactly the same as normal amateur pactor in order to discourage unintended listners from copying information not intended for them .

=Report=Report

In one case, a journalist was 'listening in' to SITOR signals across a Red Cross frequency, using AMTOR equipment, when he intercepted some private remarks from a Red Cross field team intended for internal use at the Red Cross HQ. He illegally used the contents of the message he had intercepted to write a newspaper report which was so sensational that it caused a big diplomatic incident. The result was huge costs to the Red Cross, due to the cost of relocating the persons mentioned in the article. Though Humanitarian aid organisations are hardly the CIA, they do work in very tense environments and so there is always the need to prevent messages getting into the wrong hands and being taken out of context, not to mention mischievous use of information by unscrupulous journalists.

To improve speeds still further took much more effort from the experts. More advanced modems and dedicated data coding chips were then added to

the system in order to develop a faster and yet more reliable system which would have a speed of 800 Bauds. However with so many stations already using Pactor and Swiss PTC, it was arranged for the new system to automatically recognise the correct system and select that one, while remaining compatible with ordinary SITOR as well. The new system became known as PTC-2.

Pactor is now the favourite system for use by Humanitarian aid organisations at time of writing in June of 1996, and such as the ICRC, IFRC, UNHCR etc. use it as standard. In fact it is part of the IFRC automated electronic mail system. It enables Red Cross offices in areas where there are no data services, to access the electronic mailing system in Geneva and all without the aid of radio operators in the radio room. The

main advantage is that, because the Red Cross have private frequencies, there are no costs to pay other than the first cost of the equipment.

6.19 CTCSS

Continuous Tone Controlled Squelch System (CTCSS) is offered on most VHF and UHF sets. It often happens that you have to share a frequency with another user, and their constant chatter is bothersome to listen to, leaving you to turn your volume down so low that you can't hear your own people calling you.

In a CTCSS scheme your sets emit a continuous tone while the PTT is pressed, but this is not heard in your loudspeaker. Instead, a circuit inside your set checks to see if the signal is one of yours, and if so, switches on the speaker. If not, then the speaker stays silent and your nerves are spared.

There are however some rather disturbing down sides to CTCSS. One of them is that if you recall, only one user at a time can use a frequency, so how can you tell that another user is not on the frequency? You can't, neither can they. They might be blasting across your calls and wiping you out without knowing it, and you likewise.

Hopefully they are fitted with a system which will not let them transmit unless the channel is not occupied, but if you are also so fitted, there is potential for a problem. If you press and talk, but the channel is occupied, you will transmit nothing but think you are transmitting.

Actually there will be a light or beep indication on the control panel of the radio, but will all of your people think of that? They might either think a message has got through that hasn't, or lose faith in the system when it doesn't work.

=Report=Report=

The volunteer St. John Ambulance brigade in London, England are a front line ambulance group. They supplement the London Ambulance Service and are often faced with a busy day of calls from the public, needing vital life saving assistance at once. The Ambulances are dispatched from the HQ near Baker St., in the west end of London, by simplex radio system in the VHF band. Suddenly without warning, a very powerful station, callsign 'Zero Base', started to come on the same frequency as was used for ambulance dispatch. It often happened that urgent messages to ambulances were lost, garbled and delayed when this new station just transmitted across the weaker ambulances. Pleas to the dispatcher of the intruding station were ignored. In time it was discovered, by St. John engineers, that a private security company had been allocated the same frequency as the brigade, but were using CTCSS in order to have 'privacy'. CTCSS does not give real privacy and you must understand what is actually happening when you use it.

A further problem is, suppose another organisation needs to contact you urgently and tunes to your frequency expecting to contact you. You won't hear them unless they also know of and have programmed in the CTCSS tone.

Frankly I think it isn't worth using CTCSS in simplex mode given the problems, unless the interfering stations are always weaker than yours.⁷⁰ However it is used by the UNDHA for example in their repeater systems. We must make sure that our

repeater will not pick up random interference (of which there may be plenty) and block our repeater by holding it in the transmit position. By using CTCSS, the repeater will only open when our mobiles are transmitting. The repeater downlink should be stronger than any adjacent signals so the problems are much smaller than the advantages.

Warning

CTCSS and SELCALL do NOT provide real privacy as some salesmen claim, it is an illusion. You cannot hear other stations on the same frequency, but they can easily hear you.

6.20 SELCALL

Selective Calling (SELCALL) is another scheme to overcome the problem of having to listen to other people's chat. There are various methods of it but the basic idea is the same. Each station has a built in circuit board with a unique code. Only when the code is heard will the speaker be switched on. The sender

of the message must first send the SELCALL code before trying to call the other station. SELCALL produces a very distinctive sound, like dyslexic pan pipes.

There are however two features that SELCALL offers that are different from CTCSS. One is that you can call all or only one station. You can arrange it so that when the SELCALL is received, a bell sounds in the building or the horn sounds on the vehicle. This could alert the staff to an incoming call without them having to be in earshot of the radio at all. Another feature is called revertive calling. With this, you will get an indication of some sort at the sending end if the receiving station received the code and has set off its alert horn. This can give you reassurance that the system is working. However there is also a problem with

SELCALL. It often happens that key leaders are doing more than one job in on going emergency. Suppose for example that the Duty officer has the SELCALL 101. When you call this SELCALL his personal radio and only this one will switch on. This is fine if he is carrying that particular set. Suppose that same person is also acting as first officer of the Disaster Action team at the same time. To call the First officer the SELCALL would be 102, for example. This would mean that the officer would have to carry both handsets in order to receive both calls. The situation would become more complicated if he then got in a vehicle and found that his handheld will not work so well inside the metal of the car, as the car mobile station does with its much better antenna.

Given time, some quite bizarre

scenarios can occur resulting in people having to carry several handsets around. and despite all that, have to remain near to a transportable set to receive calls intended for him in a supposedly fixed position. With SELCALL it is possible to bring back some of the bad old problems with phones and mobile phones.

The solution is for a person who is away from the radio which is normally assigned to him, to defeat the SELCALL system so that he can hear calls for him. This is done by pressing a 'def' button on the radio or, via a menu, defeating the SELCALL system. It also means that callers need both to SELCALL him and give a spoken call so that he will hear the call if listening by ear.

Another solution is for the sender, upon not receiving a response from the

called mobile, to then send the group call SELCALL. A group call SELCALL means that the sender enters in a code which is recognised by all of the mobiles in a certain group. Having opened the speakers on all mobiles, the sender can then speak out the callsign and name of the person required. When the person answers, he can state the SELCALL of the radio he is using, and the call can be set up again thus closing the other radios off during the conversation.

6.20.1 Pagers (Beepers)

A pager is a small and light radio receiver. It's size and weight mean that it is far more convenient to carry personally than, for example, a mobile phone or a two way radio. They are designed for optimum battery life, so that they can last about one month before the battery has to be changed.

They are usually powered by an ordinary disposable battery of the type that can be purchased from nearly any general store. To add to that, they are much cheaper to buy and about one fourth of the cost to run than for example a mobile phone.

A typical use for them is for callout alert. In some models, there is a loud tone when the pager is called, in some there is the option of a vibration alert so that the user will not be embarrassed if in a meeting or sound sensitive area. In this case the user will have to have pre-arranged the meaning of the alert, and either go to a pre-determined meeting point or call a phone number. Some models of pager have more than one paging sound in order that several different predetermined messages can be sent.

More expensive models feature a small

screen which may have either numbers or letters and numbers on its screen. In that case, a message can be left on the screen for the user to read later should he not hear the beeper. The pager usually remembers the last 10 messages. The sender can now send a phone number to be dialled, or a radio callsign to be called, or even leave a message (usually of up to 255 characters) giving further details of the reason for the alert.

These days pagers have become the backbone of many organisation's callout plan, with most emergency services depending on pagers to alert key staff quickly in the case of emergency. However there are some disturbing aspects to paging that you have to be aware of and have prepared for before you trust them totally. First though, lets review how they work.

Pagers are radio devices usually working at frequencies around 160MHz.

The area of coverage of them will depend entirely on the coverage of the radio base station network to which the user has subscribed. If the user roams out of the area for which he has paid a subscription, then the base stations in that area will not be programmed to call the pager and the call will be lost. If the radio waves become blocked to the user, for example if the user goes underground or in a screened place in a building, then the call will be lost. The problem is that if the alert did not reach the user for any reason, the sender will not know this. Pagers are usually one way devices and so the sender does not know if the call succeeded or failed. If the user fails to respond, the sender just has to keep paging and re-paging

until the user answers.

If the base station has been disabled by a disaster, for example by having the mast knocked down by a storm, then the signal will not be transmitted at all.

Like all radio base stations, Paging transmitters do not stand alone but need two vital services from the ground, Power and Line. A typical Pager station has enough battery back-up for about 8-16 hours operation without mains power. A long power outage will stop that station from working.

The paging stations have to know what pagers to call. To do this, the paging station receives a so called 'Paging list' from a control computer, usually situated very many miles away. This paging list in turn must come to the station usually by telephone line private wire. If the lines are down to the station

then the station will have no paging list to send.

The sender has to alert the paging computer system by phoning the office of the paging company and either speaking to an operator, or typing the message from his phone pad. If the telephone system is out of order, then you cannot call the paging centre.

For a small area of operation, say over a 10KM radius, a 'stand alone' private paging system can be installed. The coverage area of the system will now depend entirely on the position of the antenna of the transmitter. These systems are usually basic tone only systems but have the advantage that they are independent of the local telecom net, have no running costs apart from the initial cost of the equipment, and are usually very quick to install. On the down side, You do

need a radio licence for such devices unless the government has allocated a special general paging frequency for such private systems.

Apart from the same vulnerability to disaster as other conventional systems suffer, paging systems often only cover areas where there are concentrations of business users, that is, not rural areas. This is so because the profit margins on paging operations are quite small, whereas the cost of a paging station may be just as high as for any radio base station. There may be future systems operating from satellites to offset this problem, when installed, users would have global availability. However if the user cannot call his office to ask for instructions, the usefulness of these global pagers is much reduced, so in fact paging may be

best used in conjunction with another mobile communications system.

In the future it seems that paging will have competition from the mobile phone sector. The latest mobile phones are only slightly bigger and heavier than a pager, and the user has to carry a phone anyway in order to reply to the page. As the latest mobile phone systems are digital, there is little complication in building in paging capability into the phone itself. In the Short message service (SMS) offered by the GSM (Global System for Mobilecommunications) system for example, messages of under 255 characters are passed over the call set up channels, so that the message charge is very low.

The message is stored in the phone as numbers or text in much the same way as a pager, including a helpful beep.

The big advantage is that the GSM system positively knows if the message was received or not, and is able to notify the sender. It is even possible for the user to reply to the sender to acknowledge what action he will take. It seems that there are no complications to adding such a service to the future satellite services, and so they all plan to offer such a service.

In the future this will mean that the sender can call the message centre over a satellite link, and have the paging message sent down on a satellite link also, meaning immunity from ground disaster at last!

6.21 Line extenders

Line Extenders, also called 'Radio in the local loop', these are a method of extending a telephone line by radio. A station is set up in a town where there

is working telephone system, and a line is connected to the station. At the other end, a telephone is connected to a special device, which carries out the conversion of signals automatically. Versions also exist enabling many mobiles to access the line, thus enabling telephone service to be extended to them.

Line extenders are a mature and reliable product now, and they are used all over the world to provide telephone service to areas where the wiring does not penetrate. The equipment is compact and fairly cheap. The problem is that it is only as good as the local telephone exchange that you have connected to. If international connections in the area are poor, you will have not gained much over the other global methods, except perhaps cheapness. In a disaster, the local phone system will be either

destroyed or severely overloaded, so it may be best not to trust only to this method. Long term aid missions though can benefit from this arrangement very cheaply.

6.22 Mobile Phones

Many users of the communications systems mentioned so far are heartily fed up with what we have provided. They are very unhappy with the fact that they almost always have to read a complex looking manual and spend hours by trial and error before they can use the system which their engineer is so satisfied with.

What seems so much like second nature to engineers is actually hostile to users who feel that they are much too busy to fiddle with such irrelevancies.

We are living in a new era, the 'customer is always right' attitude

means that users are much less likely to put up with us techno-people if we don't deliver what they want.

Just about everyone can use a telephone. That is why the mobile phone service is so popular. This is a great technical achievement. Behind the scenes, millions of dollars worth of computers and a huge network of base stations are invisible to the user. That is why when asked what they would really wish for, nearly all aid workers rock their head to one side, sigh, and confess that they want a mobile phone.

The public mobile phone system, also known as the cellular phone system is properly known as the Public Land Mobile Network (PLMN). Mobile phone systems work in a way similar to the other systems we have described. They need base stations to connect to. In the case of a disaster, they are not likely to

be working. This is because few base stations have diesel generators, and usually have battery backup for only 8 hours of service once the mains goes off. Also, they rely on lines or microwave links going to a parent computerised switching system called the Base Station Controller (BSC) or Mobile Telephone Switching Office (MTSO). If these lines are disrupted, or the BSC has failed, then you are out of luck.

Even if the PLMN survives the disaster, one big problem is that most base stations have capacity for less than only 30 calls per cell. In a disaster, the working stations are sure to be busy with calls from local people, and you may have to wait a long time before there is a free channel at the base station to carry your call. You also have the problem of finding someone to sell

you the mobile phones for the system in operation, and setting up a valid subscription to the service. This will be very hard as the local people will no doubt have beaten you to it.

The operator of the system has a different perspective. When asked "is your system still working", he will look at his toll ticket tape, recording the money earned, and reply with a smile of satisfaction that it is working very well indeed, thank you. They rarely remember to mention that the control channels that set up the calls are completely overloaded, and in fact users are finding the system nearly useless because there is rarely a free channel when anyone tries to call them, the call then fails.⁷¹

Other users in the cell may have bottomless pits of money at their disposal, and so having seized a

channel, they hold it sometimes for days in order not to lose contact with their office. In fact, most systems offer the capability for the operator to allow only calls from 'emergency services' to get through. In practice this is seldom switched on because of the loss of money this would involve. This is a sensitive subject and one which operators are often reluctant to discuss.

If the area has the Global System for Mobilecommunications (GSM) operational in the area, you are in a much better position. GSM phones are standard over the whole world, so you could bring GSM phones from Britain, and use them in Beirut or Siagon without a problem. If people in Britain phone you on your usual number, the system will find you wherever in the world you are, and put the call through

even if the caller has no knowledge of where you are. This is called International Roaming, and is a great triumph of GSM.

Unfortunately there are still some snags. It may be that the operator of the PLMN in the disaster area has not signed a Roaming agreement with your operator at home, in which case roaming will not be possible. A bigger problem is that the GSM system is not by any means universal, so there are many places where incompatible systems are in use, so your phone can't be used. Also, in many countries, mobile service is provided only in cities, leaving no service at all once outside well populated areas.

6.23 Emergency Mobile Phone systems

Several manufacturers make quick fit emergency mobile phone systems. They consist of a kind of advanced

base station, and special mobile phones for use with them. The problem is that they usually only offer connection within the area that the base station covers. Sometimes an outside line connection is available by satellite connection by dialling a number but usually not. The big problem is that to do this they require several duplex frequencies, one for each simultaneous call plus one for the control frequencies. You could not use it unless the government authority in the area agrees. This could take quite some time. In addition, it is much more expensive than the conventional systems just described but not any more effective, so you would need to justify the cost.

Another solution is the DECT system, a self organising mobile communications system rather like a mini mobile phone

**network. This has been described in ch
6.2.1.**

6.24 Position finding systems

At first, position finding may seem to be an unnecessary complication to an already expensive and complex operation. but consider for a moment the kind of problems faced by field staff. In the first phase, a 'rec' team will have to assess the needs of the prospective clients. Often, the team are driving in a place where they have never been before, and often without the aid of road signs because they have been destroyed by the disaster, are in an unreadable script, or have never been provided. Even a map is useless unless you know your present position. Upon reaching the scene of the greatest need, they will now have to find the name of the place that they have found,

but again, will they be able to do that, or unambiguously pronounce the name of the place?

Having compiled their report and moved on, the main supply vehicles must now find the same place, so that the 'clients' identified by the 'rec' team can be helped without delay. Finding and then re-finding places becomes so difficult that many operations leave this job of distribution to local militias or other 'helpful' persons. The result is often that the supplies end up in the hands of 'sergeant Bilko' types and find their way into the black market economy rather than to the needy victims. Clearly, delivering the supplies that you have paid for to the users that you have intended is much better.

Safety is another factor. Should your field staff get into trouble and urgently need help, the rescue teams cannot

help unless they accurately know the position of the distressed field team. This is why, at sea, the very first thing a ship must send over the radio during a mayday call, is its position. If the radio then fails, the rescue ships at least know where to go to find out what is wrong.

These then are among the many reasons why a humanitarian aid field unit may want quite accurate position fixing. Until about 1995, such devices were much too expensive and impractical for use by such small NGO's with small budgets, but by 1995 all that has changed. By that time, hand-held battery powered units with all the desired capabilities were about USD 300-500, which is about the same size weight and cost as one handheld radio. The dominant system is use at the time

of writing, at the end of 1996 is the Global Positioning System (GPS).

By the turn of the century it is expected that most of the new LEOsat satellite phone systems will offer position fixing as a standard part of the service and so very soon position fixing will become an indispensable part of the many new products and services. For the moment though, let us look at some of the ways of using GPS.

GPS was developed for position fixing at sea in the air, and for the positioning of missiles. The GPS receiver on the ground finds its range to two or more satellites that could be in view of him. A computer inside the GPS unit computes its position based on the range to those satellites and the position of the satellites at the time the ranges were made. For the satellites to know their position, they have to have accurate

clock, so a further bonus of GPS is very accurate time.

At sea or in the air a latitude and longitude position is very useful. There are few other relative landmarks to reference to anyway. On the ground however we want to find our way along a road network to reach a certain town or village, so for the position information to be any use at all, we would need to have maps with the lat and long grid printed over them. I have to tell you now that most useful road maps do not offer this, whereas most useful lat and long maps are not much good at showing ground detail and in any case cannot be purchased at an airport petrol station.

The alternative is to use 'relative positioning'. Suppose that you arrive at a city in the disaster zone, and are given a road map, that you purchased

at the airport petrol station, to find your way to the next rendezvous. What you would do is go to a place on the map which is very distinct. Go there (or send someone there) and Using the GPS, find the exact position of this place. It will now become a WAYPOINT. Record this waypoint in your book and agree with other members of your organisation the name of this waypoint and its absolute (lat and long) position. You will have to do this because other teams may have a different map with a different scale, colour code scheme, icon scheme and grid system to the one you are using.

Your map will hopefully have a reasonable scale printed on the border, and an indication of which way is north, though this is usually (but not always) the direction pointing straight up. Now mark the position of the place you want to go next. This will be another

waypoint, you can name it what you like but the place name on the map is best (provided you can read and pronounce it!). Using a ruler and divider, you can draw a line between the two places and measure the line. You now know the direction and range of the other waypoint. You can now type this information into your GPS, and it will remember the location of the two waypoints, and even calculate the absolute lat and long of the other waypoint for you.

Well, that was jolly good schoolboy fun, but why did we do that? As you drive down the rutted roads in the bad weather for hours, you will probably wonder where you are and if you are going in the right direction at all. Your GPS will probably be battery powered, so rather than leave it on all the time

you should switch it on only when you need position information. You would then switch on your GPS, and ask it what is the range and direction, from where you are now, to any of the waypoints you have entered into its memory. You will get a readout saying, "270 degrees 7Km". Now you can pinpoint yourself on the rather sparse map you have, even without any grid marks on the map and even if there is no landmark at that point. Furthermore, if you have a compass, you can use the direction for steering, provided the road system is simple enough. However you must be clear if the bearing shown on the GPS screen, is the bearing FROM the waypoint or TO it (or you could be driving the wrong way.. it has happened).

When you arrive at the scene of some

obvious need, you can ask GPS for the position, and create a new waypoint at this spot. You can then use the relative information about how far away from another known waypoint this is, to draw its position accurately on you map. You can also use the absolute lat and long position to send to the other teams by radio, so that they can mark it in on their maps and find their way more easily. They will also know if they have got the right spot.

Used wisely, GPS can give a great deal of time and money saving help, and all at very modest outlay. GPS will probably be in service for many years to come and so you can invest without fear of the equipment becoming obsolete very soon. However it is important to remember to ask for a model that can calculate waypoints and give relative positions, or GPS will be

useless without lat and Long maps, which you can bet will not be available to you. You should also share waypoint information with other teams, and collect positions from them. This not only saves misunderstanding, but adds a significant safety factor, you never know when they will fail to report and you will have to find them without being able to communicate with them. You should likewise report to someone else what waypoints you are expecting to be visiting before your next communication.

There are other systems than GPS for position finding, some based on ground based transmitter stations, such as Decca, Omega and Loran. However these are vulnerable to the user straying out of the range of the system, and to the failure of the ground based radio base stations providing the

signals. The advantage of spaced bases systems such as GPS, Transit and Glonass, is that they are immune from land based disasters, and have global coverage.

6.25 The Future

In the future we could have advanced satellite systems offering global mobile phone systems at a very reasonable cost. When that happens, then the users will at last have what they think they really need. It is also thought that there will be a kind of satellite version of packet radio, giving access to Internet. A world wide library system called World Wide Web will make it possible to for example fetch maps and photographs of a place together with a detailed guidebook about it instantly on your screen. You will be able to read this book on your screen as it too will

be on the WWW (it is hoped).

However this will not make your investment in the conventional systems obsolete because the future systems may be just as prone to overloading as the present ones are. Therefore you should consider them to be your secondary system until they mature, well into the first decade of the 21st century. It is an exciting future for the communications industry, but also a confusing one, that is why DRCF is here to help you. Future revisions of Disaster Communications will include anything promising that comes up. To do this we need your help, both financially and with information.

There is also excitement on the legal front. Remember all the legal hurdles to getting even a simple system set up?

Well in 1996 there will be an International Convention on Emergency

Telecommunications, which, it is hoped, will clarify and simplify the situation. The aim is to make moving equipment across borders easier and setting up emergency communications systems rapid and efficient by bringing in new legislation. It is hoped that many countries will sign up for an agreement to allow a waiver of the usual red tape in the case of an acute emergency, but of course there will be many terms and conditions to be met by prospective foreign rescue teams. The DRCF will be here explain them.

6.26 Training

Everyone realises the need for better training of key staff in the arts of Emergency Telecommunications. Not just techno- waffle for the boffins, but down to earth clear grounding for the decision makers in our business.

Many of the decision makers in aid and

disaster work are intelligent, experienced and highly motivated people. Few however have any kind of telecommunications background and this often results in the application of technology which is sometimes less than appropriate. These are busy people who need courses that will fill their needs for keeping up to date with today's can-do technology but keeping the language at popular level.

The DRCF and several other groups are actively working on establishing a framework for defining target groups for training and developing such courses. It is hoped to be able to offer theoretical and practical courses covering all aspects of this work, from a co-operative and co-ordinated base, within a time scale of about two years.

This book will be updated and expanded as experts submit more input

to it. In addition it is proposed to add smaller booklets about topics which attract popular attention.

We have a lot to do before the International Decade for Natural Disaster Reduction (IDNDR) is out!

⁶⁶In fact they go to the trouble of arranging 'talk through' systems on their duplex base stations to give this effect.

⁶⁷See Appendix for the full International Phonetic Alphabet.

⁶⁸The antennas for Liverpool Coastguard's Marine Rescue Centre at Bootle are on top of Blackpool Tower, giving a commanding coverage of the Irish Sea.

⁶⁹The UNDHA portable repeater for use

at a disaster site has enough self contained battery power for 24hrs sustained operation.

70 A personal opinion, your experts may advise otherwise.

71 During the Koybe earthquake disaster, the mobile phone system survived in tact. The operators claim that service was provided without overload throughout the rescue period- Ericsson.

CHAPTER 7

7 SUMMARY

The needs of disaster and aid users are in some respects different.

Disaster communicators want something small, light, portable and working now, no awkward if's and buts. They have only 12Hrs notice for planning time and must be on station in 24Hrs. Installations will be temporary, so no installation engineering is needed.

Aid users want something at the camp or office, semi-fixed, reliable and easy to use and hard to abuse, (you can't always tell who will end up using it). The difference is that there is usually some time to plan and engineer the installation. As installations are permanent, then better engineering is desirable.

Technology can do wonderful things for us but at a price. You must ask how much money you want to spend.

If you have USD 10,000 then standard-M with its direct dial convenience and dead easy operation may appeal.

For USD 5,000, Standard-C with its professional reliable Text system and small size may be for you.

Or for USD 1-2,000, HF radio will do a splendid job in the right hands.

Probably the best value for money is in the use of the Gateway service from Portishead Radio by HF radio and using the Phonetext mode, where the problems of time mismatch are obviated.

Planning an adequate Power supply needs much careful thought.

By far the biggest problems you will face will be the political ones. Getting the paperwork wrong will mean failure to be able to use the equipment you have spent so much money on. Make sure you take good advice from the appropriate authorities before attempting to bring anything in to a country.

7.1 System integration

By now you will have realised that operating a communications network is much more involved than it first appears. If you can, then recruit a Radio Officer with varied current experience or radiocommunications specialist to take care of these matters for you. Otherwise, there are consultants who can take care of these matters for you, they will charge you for their services but they will save you money in the long run by improved communications.

Another strategy is to find an organisation like yours, which seems to have a good communications system. You could then either contract their technicians to help you with your network, or just get permission to study and copy their most successful ideas. Another approach may be a Memorandum of Understanding (MoU). This is a kind of 'contract' in which you agree to use their resources under certain specified conditions, in return for some kind of favour.

7.2 Turnkey contracts

This is more for Long term 'aid' projects and not suitable for Emergency comms. Turnkey contracts mean that the contractor will do all the work needed to fix up a working network for you. All you have to do is 'open the door' or 'Turn the key' and step in to a working system.

Here is a warning;

When you order equipment from a manufacturer, he will deliver just what you ordered. He is not a mind reader, remember 'The customer is always right! so he will faithfully ship out what you say to where you say. We at DRCF have many stories on record from frustrated users and manufacturers alike who shipped out equipment that could not be made to work when the box was opened in Africa.

This happened because the buyers did not specify ALL of the parts needed to turn a basic radio into a working installation. Often there was not a radio technician for hundreds of miles around so already hard pressed staff decided to do without the equipment rather than spend time trying to fix it up.

Even when equipment is installed before shipping, it is often found to be incomplete or unsuitable when arriving in the field because of inadequate quality supervision by experienced specialists. The root cause of that is the shortage of the specialist experts in this vital field.

One way around this is to have your own communications Department⁷² in your group who have someone responsible for all these complex matters. But it is important to recruit the right person for this demanding job.

Another way is use either hired experts from a good consultancy company, or the experts from the dealers of the equipment that you decide to buy.

When you specify a TURNKEY contract from a Systems Integration House, you may gasp at the price you are quoted, but this will be a proper reflection of the true cost of the operation whether completed by you or the dealer. On the other hand, spending money on equipment which didn't work at the moment it was really needed will not go down well in any boardroom, and be a treacherous betrayal of the poor foot soldier at the front end of the job, who will have frustrating equipment inadequacies to add to his other heartbreaks.

7.3 Maintenance

As Murphy's rule so well puts it.. "anything that can go wrong will go wrong". You need to think about repairing and maintaining your system. Your system must be installed correctly in order for the mean time between failures (MTBF) of your system to be respectable. You need to have your system regularly inspected and maintained by competent technicians in order to prevent faults from occurring and when faults do occur, you want fast solutions to get you back on your feet.

In the first response to a disaster situation, this means that you will have to have highly competent technicians 'on call' ready to go out with your equipment in the first line of support staff. They will need to be well briefed, drilled and properly equipped for any installation and repair work they may need to do. In the second line, you will need to have rapid access to the spares needed to bring you back on line again, all of which means preparation in order that stores and spares arriving on the scene are the ones needed and can do the job. In the longer term, you will need to have contracts with a reliable maintenance company, and keep them informed about what type of equipment you have and how it is maintained.

None of this is exciting stuff, but you cannot afford to ignore the frailties of the technology we need for today's operations.

Use technology but don't trust it.

There is nothing more human than a machine.

7.4 DRCF's role

The DRCF can also help with advice and also with men and equipment ready to go out in the field. However our resources are limited at the moment so you may need professional help even after DRCF help has been sought. In the future it is hoped to expand our operation to meet the obvious need vacuum in this field, but we will never replace the work of the dealers and consultants and neither would we wish to.

In DRCF's case, with limited resources, yet a need to be insured against equipment failure and a desire to be most flexible, we have chosen to use Standard-C and HF radio side-by-side. This gives the best of both worlds at the most reasonable cost. Standard-C gives reliable, compact and quick-pop-up service with text hard copy, while HF radio is for phone calls and as back up for the standard-C. Another important reason for not forgetting HF radio is that it may be needed in local mode for contacting other local agencies in the area using only HF radio.

Individual cases though require much thought at the planning stage, so we would always recommend the services of a consultant before spending large amounts of money.

May I wish you **73's**, which is radio code for "Best Wishes"

Mark Wood, Stockholm Sweden, June 1996

The Disaster Relief communications Foundation (UK).

⁷²The CICR have such a special department staffed by former Marine Radio Officers for this reason.