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DISASTER COMMUNICATIONS

= AFFORDABLE TELECOMMUNICATIONS FOR NON-GOVERNMENTAL ORGANISATIONS (NGOs) ENGAGED IN DISASTER RELIEF AND HUMANITARIAN AID DURING THE ACUTE PHASE OF AN EMERGENCY = IN PLAIN LANGUAGE = ...MORE+

Mark Wood ,
The Disaster Relief Communications Foundation (UK).



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Disaster Communications

First Edition Published June 1996

by
Mark Wood (G4HLZ)



The Disaster Relief Communications Foundation (UK).

ISBN 0 9526483 0 X

DOJ EX. 1025

Disaster Communications First edition .. Aims and Objectives

Target Group

This document is intended for the training of non-technical staff of NGO's who need background information about the available and future Telecommunications systems for use in the acute phase of an emergency. It is hoped to enable the decision makers to make more informed and more appropriate decisions by bridging the gap between the experts and the decision makers.

The information will also be of use to the users in the field, Humanitarian Aid workers upon whom are great demands and unbearable stresses. The document is arranged to enable a user to refresh his knowledge of a subject quickly, which is why there is some repetition.

Students of Telecommunications will also benefit from reading of the options available for telecommunications in the face of total failure of the Barer network.

Aims and Objectives

In part 1, Readers will be introduced to the problems of working in a disaster area where normal telecommunications systems are not working, and the field team need to contact their office in their country of origin. The relative merits of voice and text messages will be discussed. The available satellite and HF radio systems will be explained. The considerations of power and the legal implications involved will be investigated.

In part 2 the question of communications in the short range between units in the field will be discussed with reference to past, present and future systems.

An index serves to look up acronyms and cross refer to other paragraphs of interest.

An appendix contains contributions from other organisations as will as tutorials giving more detail about some points of interest.

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Disaster Communications

Affordable Telecommunications systems intended for use by small NGO's during the acute phase of an emergency-
A 'plain language' guide.

ISBN 0 9526483 0 X

Mark Wood (G4HLZ)

First Edition Published June 1996
The Disaster Relief Communications Foundation (UK).
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This is a training document and contains simplifications. It should not be considered to be a specification of any system. Official clarification must be sought from the relevant authorities (see appendix).

Despite strenuous efforts to ensure the accuracy of the contents, DRCF accepts no obligation for the accuracy of the contents of this document or damages arising from the use of the information herein.

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Dedications and acknowlegements :-

LC Control Number
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This book is dedicated to my wife Nina, who patiently puts up with my obsessions,

And to the Dedicated Men and Women of the World's Humanitarian Aid organisations who valiantly care for the most vulnerable, sometimes at great cost and personal danger to themselves.

This Document has been made possible by the generous assistance of many experts in the Emergency Telecommunications field, All of whom have contributed their time without charge, and without whom this document could not have been written. I would like to give special thanks to the following for their contributions:-

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Michael Goddard, Director of Spectrum Policy of the UK Radiocommunications Agency.

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...And the many other patient chaps who have been kept awake at night by my 'phone calls; **My thanks to you all.**

Mark Wood.

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Foreword

I suspect that most of us take communications for granted. We enjoy the instant delivery of television and radio programmes, we expect to be able to make telephone calls from fixed or mobile telephones and we have access to a plethora of other telecommunications and radiocommunications services, often without realising that we are using them. The ease with which we can utilise these services tends to hide the complexity of the infrastructures that enable one person to communicate almost instantly with another, even on the opposite side of the world. As we approach the end of the millennium, the richness of communications services grows ever more rapidly, it is difficult to imagine what life would be like without the ability to communicate.

So what happens when disaster strikes? Whether the cause is man made as in the ease of civil conflict or international wars, or natural as in the case of earthquakes, major flooding or other "acts of God", the impact can be catastrophic. Communications infrastructures and even the power supplies and building that support them can be destroyed or at least disabled. Qualified personnel may not be available to restore communication, and in some cases the government itself may be unable to mobilise remedial action or even take decisions. And yet in such a crisis, decisions need to be taken, priorities set, human and other resources deployed and vital services restored. Medical and other aid may be needed on an international scale to alleviate suffering and prevent further devastation. For all of these requirements people need to be able to communicate, often over long distances, despite the breakdown in previously existing facilities. The rapid restoration of communications becomes therefore one of the highest priorities. For this purpose, radiocommunicications can often provide the most effective answer. However care has to be taken to ensure that the communications are effective without threatening other important legitimate radio usage.

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The Disaster Relief Communications Foundation is organised to assist in such cases and this book, which I believe is the first of its kind in this field, presents a practical guide to implementing basic communications facilities. It is written by someone who appreciates the practical aspects of working in difficult environments, often with an extremely limited budget. It recognises the need to put across the inevitable technical solutions with their own jargon in a straightforward way for the non-specialist. And it attempts to steer a carefully balanced line between expediting the restoration of communication and respecting the authority of international agreements and national government policies. As a result the book is a training manual for those engaged in, or associated with, this crucial work. If it helps to relive suffering in just one instance then the effort in producing it will have been more than worthwhile. I am confident that it will do much more.

Michael Goddard, BSc, CEng, FIEE
Director - Spectrum Policy
Radiocommunications Agency
London.

DOJ EX. 1025

Table of Contents

CHAPTER 1 Introduction

1.1 INTRODUCTION 1
1.1.2 What Is Disaster Communications ? 5
1.1.3 Differences to Aid Communications 7
1.1.4 Emergency Services communications 7
1.2 WHAT DO WE WANT? 8
1.2.1 FOR PHONE 9
1.2.2 AGAINST PHONE 9
1.2.3 For Text 10
1.2.4 AGAINST TEXT 12
1.2.5 FOR FAX 14
1.2.6 AGAINST FAX 16
1.2.7 SEMI-FAX 16
1.2.8 ISDN 17
1.2.9 Internet Electronic Mail 17
1.2.10 World Wide Web 19
1.3 Networks 20
1.3.1 Trafficking messages 22
1.3.2 Keeping a Log 23
1.3.3 Echo Tests 24
1.3.4 Summary 25

Chapter 2 Satellite systems

2 SATELLITE SYSTEMS 27
2.1 THE INMARSAT SYSTEM 28
2.1.1 FOR INMARSAT-A 30
2.1.2 AGAINST INMARSAT-A 31
2.1.3 INMARSAT-B 31
2.1.4 FOR INMARSAT-C 32
2.1.5 AGAINST INMARSAT-C 33
2.1.6 FOR INMARSAT-M 33
2.1.7 AGAINST INMARSAT-M 34
2.1.8 Data over INMARSAT 35
2.2 FLEET MANAGEMENT SYSTEMS 35
2.3 Regional satellite systems 36
2.4 LEO systems 36
2.5 Satellite Dispatcher systems 38

Chapter 3 HF radio (Terrestrial systems)

3 HF RADIO (TERRESTRIAL SYSTEMS) 41
3.1 INTRODUCTION 41
3.1.2 HF RADIO EQUIPMENT 45
3.1.2.1 Modulation Modes 46

DOJ EX. 1025

3.1.3 ANTENNAS 49
3.1.3.1 ATUs 49
3.1.4 DIPOLES 50
3.1.4.1 Widebanders 50
3.1.5 VERTICALS 50
3.1.6 BEAMS 51
3.1.7 LOOPS 51
3.1.8 Multi Antenna systems 52
3.2 MARINE RADIO 53
3.2.2 HOW IT IS USED 55
3.2.3 FOR MARINE RADIO 56
3.2.4 AGAINST MARINE RADIO 57
3.2.5 FOR AUTOLINK 58
3.2.6 AGAINST AUTOLINK 58
3.3 GATEWAY SERVICES 58
3.3.1 FOR GATEWAY 59
3.3.2 AGAINST GATEWAY 59
3.4 Amateur Radio Service 60
3.4.1 Resolution 640 61
3.4.2 For Amateur Radio 62
3.4.3 Against Amateur Radio 62
3.5 'Private' HF radio networks 63

Chapter 4 Power

4 Power 65
4.1.1 Batteries 65
4.1.2 Vehicle batteries 66
4.1.3 Dual Battery schemes 67
4.1.4 Power Banks 68
4.1.5 Portable battery packs 68
4.1.6 Maintenance 69
4.2 Power Supply Systems 70
4.2.1 Battery chargers 71
4.2.2 Trickle Chargers 71
4.2.3 Float Charging 72
4.2.4 Power Supply Units 72
4.2.4.1 Caveat 73
4.3.1 Invertor 74
4.3.2 Uninterruptable Power Supplies 75
4.3.3 Voltage Regulators 76
4.4 Generator Sets 77
4.4.1 Rating 78
4.4.2 Redundancy strategies 78
4.4.3 Observing the Load 80
4.4.4 Frequency stability 80
4.4.5 Don'ts 81
4.4.6 Fuel 83
4.4.7 Diesel 83
4.4.8 Petrol 84
4.4.9 Cleanliness 85
4.4.10 Siting 85

DOJ EX. 1025

4.5.1 Distribution 86
4.6 Other Auxiliaries 87
4.6.1 Transformers 87
4.7 Alternative energy 88
4.7.1 Wind Turbines 88
4.7.2 Solar Panels 89
4.8 Summary 90

Chapter 5 Legal issues

5.1 Introduction 91
5.2 ITU 93
5.3 WGET 94
5.4 UNDHA, DMT and UNDAC 94
5.5 NGOs 96
5.6 Tampere Declaration, 1991 96
5.7 ITU Buenos Aires 1994. 99
5.8 ITU Plenipotentiary Conference, Kyoto 1994 100
5.9 ITU Resolution 640 100
5.10 Reservations 104
5.11 Conclusion 105
5.12 Slow Track 106
5.13 Licences and frequency allocations 106
5.14 Licence fee 107
5.15 Type Approval 108
5.16 Import Licences 108
5.17 TIR 108
5.18 Pro Forma Invoice 109
5.19 Draft of 'Disaster Telecomms' Convention 109
5.20 Summary and Remarks 138

Chapter 6 Local communications

6.1 Introduction. 139
6.2.1 For field telephones 140
6.2.2 Against field telephones 143
6.2.3 Private Wires 145
6.2.4 PAX and PBX systems 145
6.2.5 Cordless PBX 147
6.3 'Walkie-Talkies' 147
6.3.1 Procedures 150
6.3.2 Callsigns 152
6.3.3 What is the range of them? 153
6.3.4 External antennas 155
6.4 Mobile Stations 158
6.5 Power Output 159
6.6 Transportable units 160
6.7 Base Stations 161
6.8 Automatic repeaters 163
6.9 Channels 165
6.9.1 Trunked repeater systems 168

DOJ EX. 1025

6.10 CB 171
6.11 Amateur Radio 173
6.12 HF Radio 175
6.13 Allocations 176
6.14 Antennas 177
6.14.1 Scanners 179
6.15 HF Amateur Radio 179
6.16 Data by radio 180
6.16.1 The problem 181
6.16.2 Packet Radio 181
6.16.3 Digipeating 182
6.16.4 Mailboxes 183
6.17 Satellite Packet Radio 183
6.18 Teleprinter Over Radio (TOR) 184
6.18.1 Pactor 185
6.19 CTCSS 186
6.20 Selcall 188
6.21 Line extenders 193
6.20.1 Pagers (Beepers) 190
6.21 Line extenders 193
6.22 Mobile Phones 193
6.23 Emergency Mobile Phone systems 195
6.24 position finding systems 196
6.25 The Future 199
6.26 Training 200

Chapter 7 Summary

7 SUMMARY 203
7.1 System integration 204
7.2 Turnkey contracts 204
7.3 Maintenance 206
7.4 DRCF's role 206

INDEX 208

DOJ EX. 1025

DISASTER COMMUNICATIONS

PART 1 GLOBAL

First Edition, June 1996

Mark Wood, G4HLZ

of the

The Disaster Relief Communications Foundation

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.

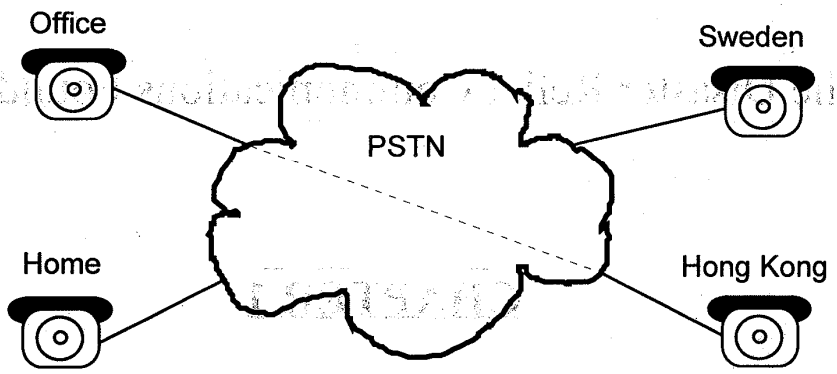


***Fig 1** The Public Switched Telephone Network (PSTN) is the largest single structure ever made by man.*

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 Phones[2] 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 to too much traffic for it to handle, and so it will become overloaded, so you will keep

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

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.

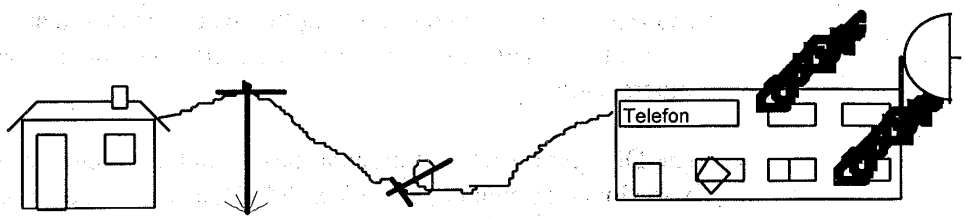


***FIG 2** The PSTN actually depends on telephone exchanges and lines on the ground which are vulnerable in times of crisis.*[4]

```
=REPORT=REPORT=

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'

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

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)

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

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 24hrs 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.

Authors 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.

[6]Disaster 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.
[7]In this book men shall also mean women.

DOJ EX. 1025

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.

```
=REPORT=REPORT=

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
```

[8] Because 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.
[9] Qualified Radio Officers are well suited to Disaster Communications duties.

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 Officers[10] 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 Operators[11] 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

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

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 callsign 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 he[13] 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.

```
=REPORT=REPORT=

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 dialled. Sometimes the voice from the

[12] When 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'.
[13] In this document, He or Him shall mean She or Her.
[14] You can tell your coast radio station to interrupt you when a certain time or a certain charge is up.

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 24Hr 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 sender[15] does not have to worry about the

[15] In 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

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 travelling 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 computer[16] 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 serous 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 unattended[17], 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

addressee(s).
[16] In this document the term Personal Computer will mean in the generic sense.
[17] Provided there is reliable power and security.

DOJ EX. 1025

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.

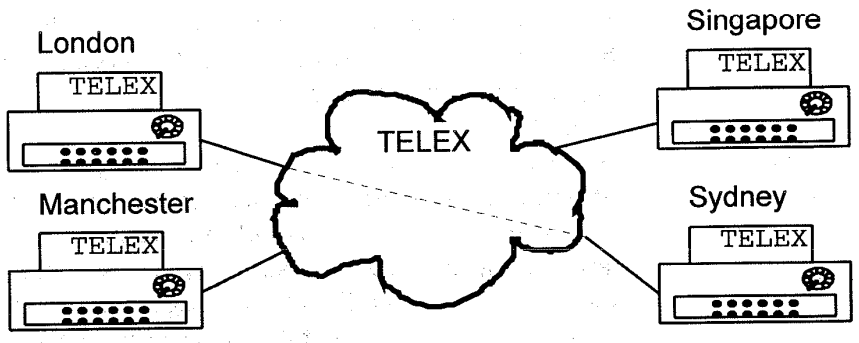


***FIG 3** The international TELEX system is the text version of the PSTN. Any TELEX can 'dial' any other telex and leave a message even if the receiving machine is unattended.*

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

DOJ EX. 1025

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 Top[18] Personal Computers 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.

```
=REPORT=REPORT=

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

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

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.

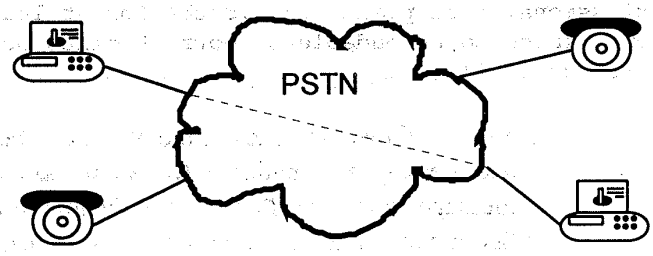


***FIG 4** FAXes use the ordinary PSTN network.*

DOJ EX. 1025

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.

```
=REPORT=REPORT=

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).

```
=REPORT=REPORT=

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 recipiant. 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

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

DOJ EX. 1025

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

[20] Very often used by the UN and others.
[21] In 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.

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.

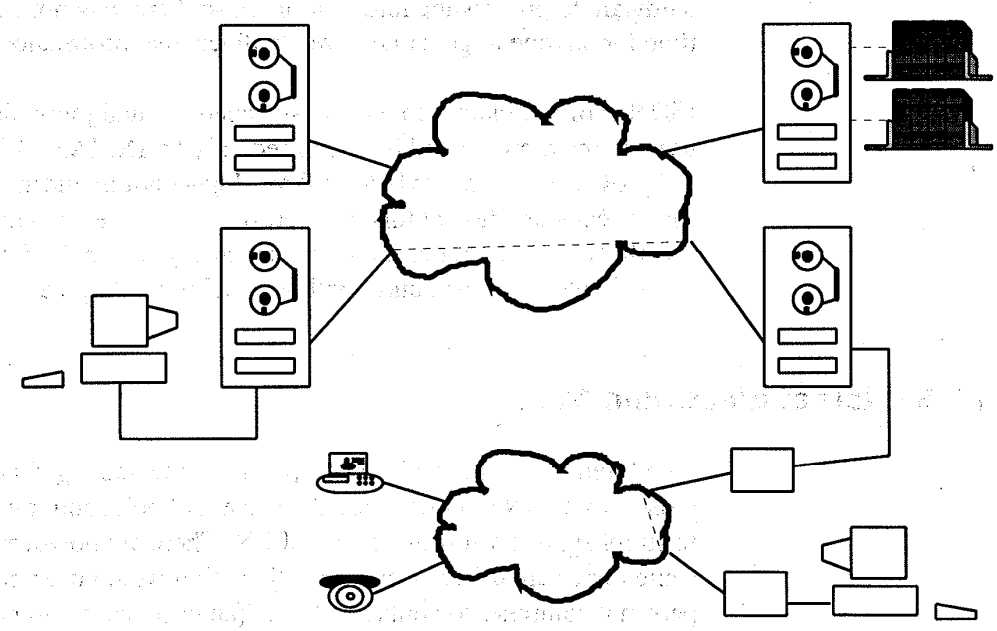


Fig 5 ISDN is like a 'phone system' for computers enabling them contact each other. This is how services like Internet and World Wide Web are supported.

DOJ EX. 1025

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 signalling, 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 un attended. 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?

[22]Only INMARSAT-C and HF radio (in good conditions) can be used in a moving vehicle.
[23]Cordless phones can be directly connected to some models of INMARSAT terminal

DOJ EX. 1025

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.

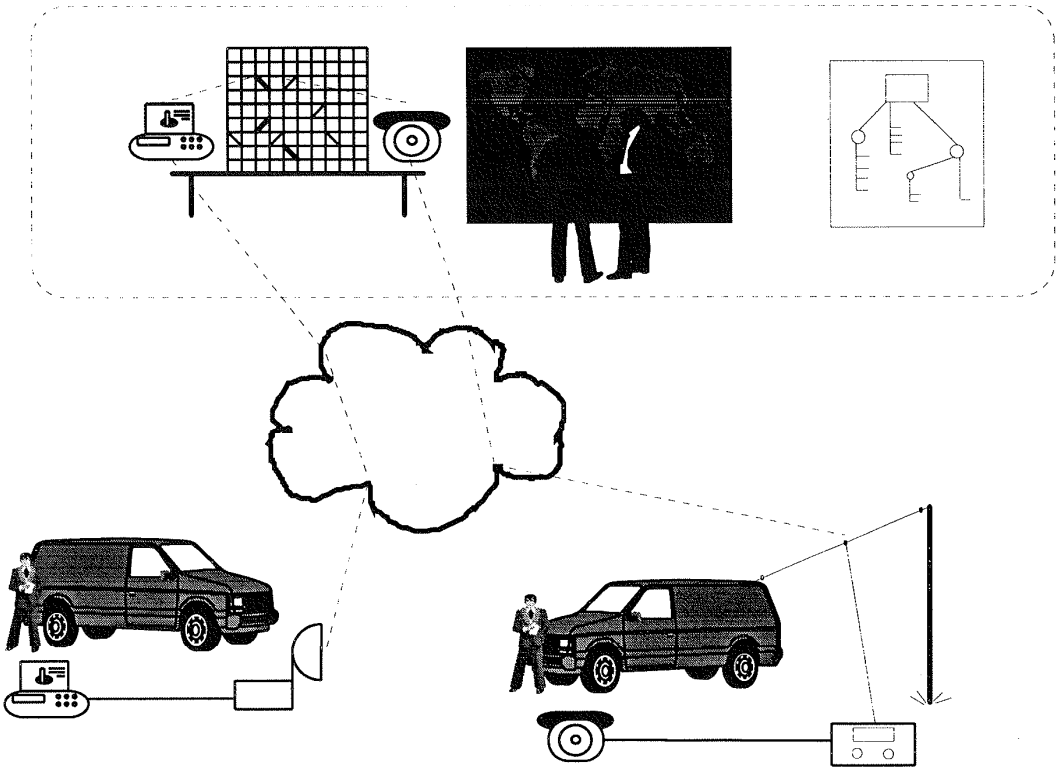


***FIG 6** Having a Traffic Dispatch function maximises the value of any system.*

=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+
```

Fig8 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

[24]This is a legal requirement in most countries.

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]

FIG9 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

[25] There 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.

[26] Many 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.

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 organisations[27] 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 Geneve. Information about how to work with them is available from the UNDHA telecommunications centre at the Palace du Nations in Geneve.

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

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

start looking at what is on offer.

DOJ EX. 1025

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, Odysey, 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

[28] Estimates vary from 1998 to 2010.

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.

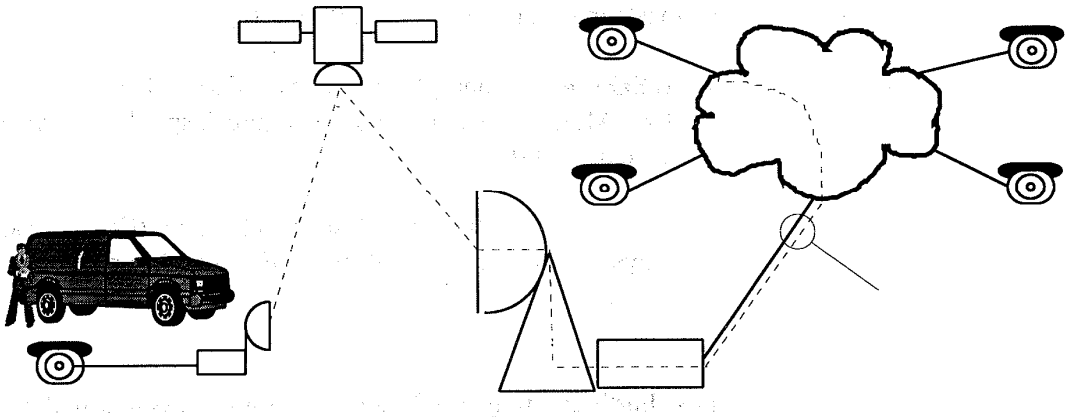


***Fig 10** The INMARSAT system connects you to the PSTN, TELEX or ISDN*

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)

2.1.1FOR 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

[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.

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, USD4-5 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.

[30] I)INMARSAT promises to support Standard-A until at least 2005.

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.

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

DOJ EX. 1025

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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=REPORT=REPORT=

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
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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.

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 explaination 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

[32]The 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.

call is being placed .[33]

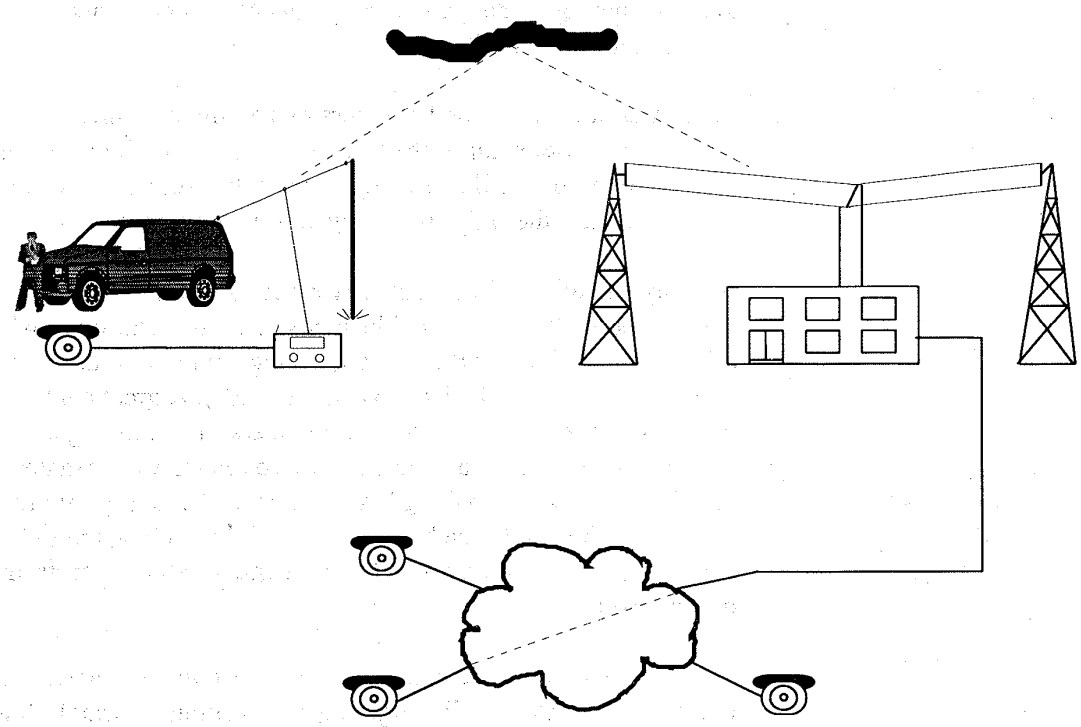


FIG 11 *Coast Stations enable HF radios to 'plug in' to the PSTN, or TELEX network.*

The Coast Station receives the message[34] 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,

[33]Information 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.
[34]The 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.

DOJ EX. 1025

position and reflectiveness as it adapts, responding to solar flares and magnetic storms in space[35]. 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, 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,[37] (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

[35]Many 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.
[36]You can receive predictions of propagation from Portishead Radio either as charts or by automatic telex data bank.
[37]This is a very rough figure. The 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.

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.

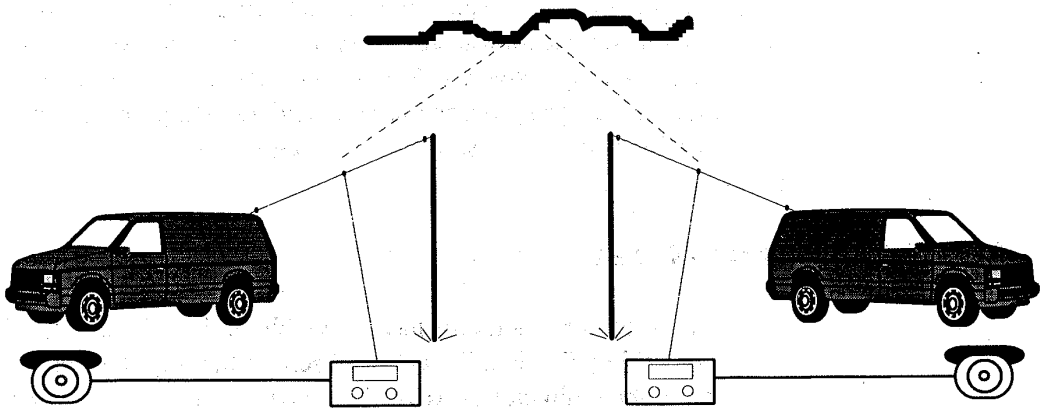


FIG 12 HF radios can contact each other directly over thousands of km. This method is ***FREE*** *of call charges.*

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 it's 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

[38] Actually 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.

DOJ EX. 1025

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.
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Teleprinter Over Radio (TOR) is finding many friends these days so without going into details, here is an explanation of

[39] Also known as TOR, it is the same as Amateur Microprocessor Teledata over Radio (AMTOR).
[40] Experts reckon SITOR to be the most reliable HF radio system yet devised.
[41] Or just a modem

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.

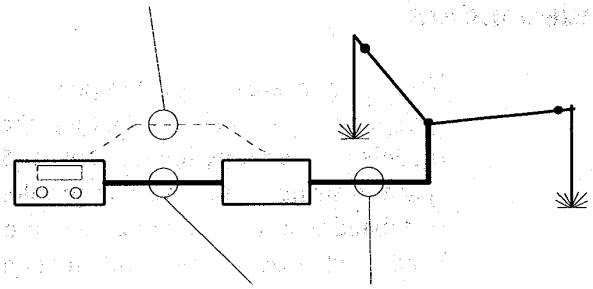


***FIG 13** The position of an ATU.*

[42] There 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.

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

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. 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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=REPORT=REPORT=

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.
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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.[44] 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.

[44] However 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.

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,

[45] For 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).

[46] The 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.

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

- 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).

[48] A 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.

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 transcievers used on Marine service must be capable of split frequency (DUPLEX OR SEMI-DUPLEX) operation.

[49]You 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.

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.

[50] A 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.

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 trafficing, 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]

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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 global[53] 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.

[51] The 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.
[52] UNDHA uses the transmitters of the Swiss PTT on a permanent lease basis.
[53] When 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

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

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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

[55]The 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.

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.

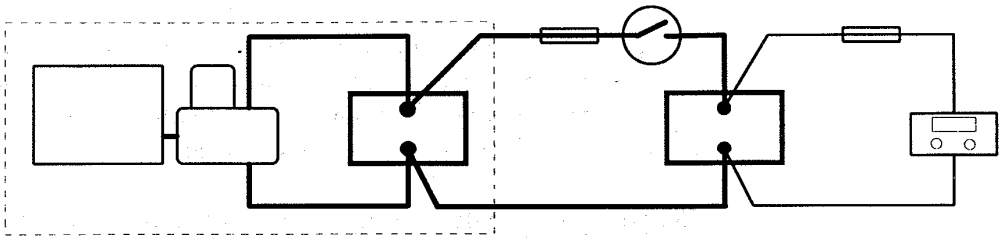


FIG 14 Dual battery schemes prevent vehicle battery flattening but rely on the operator remembering when to operate the switch

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 looses 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

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

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.
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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 regulators[57] 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 Chargers

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.

[57] Many 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.

DOJ EX. 1025

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 (PSU)

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 PSU 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 theses 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.

DOJ EX. 1025

4.3.2 Uninterruptable Power Supplies (UPSs)

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.

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

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 salesmen 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.

DOJ EX. 1025

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.

[59] and officially no engine oil either.

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.**

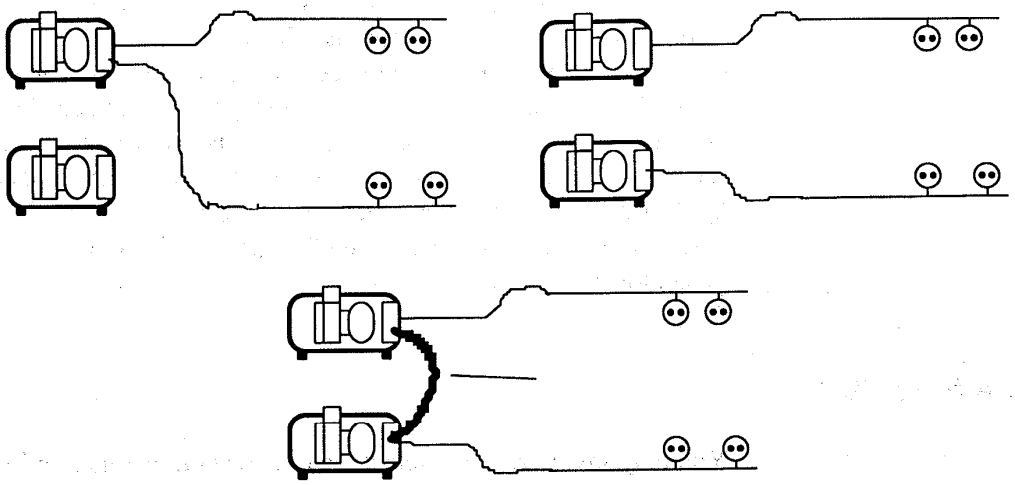


Fig 15 In case of gen failure, or to save fuel when loads are light, one genny can be connected to both lines but two gennys must never be connected together

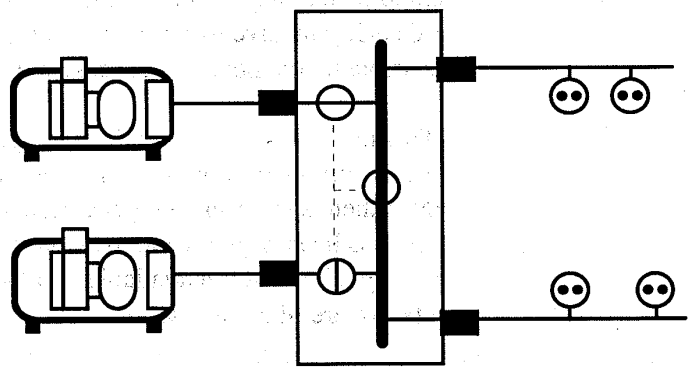


FIG16 A more professional method for a permanent installation is to use a special interlock box making a mistake impossible..

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

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

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, you 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

DOJ EX. 1025

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,

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

DOJ EX. 1025

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 is 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.

[62] Units rated below 250W are often very quiet.

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 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 if 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.

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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.

[63] In 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.

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.

[64] Disaster 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.

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 Geneve.

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 t*he 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 UNDRO* (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*

[65] The declaration is now annexed to WTDC Nr7

removing regulation barriers and strengthening transboundry 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 cnds 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.

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=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
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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

WORKING DRAFT/3/18-4-96

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 DisasterCommunications, which the International Telecommunication UnionPlenipotentiary 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, andnon-governmental humanitarian organizations work to increase their effectiveness by addressing regulatory, operational, and technical aspectsof emergency telecommunica tions—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 telecom munication 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 telecom munication 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 telecom munication 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.

DOJ EX. 1025

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 depository, (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 depository. 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 depository 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 depository 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 depository 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.

DOJ EX. 1025

DISASTER COMMUNICATIONS

PART 2 LOCAL

Mark Wood

The Disaster Relief Communications Foundation

CHAPTER 6

6.1 Introduction.

In Part 1, "Disaster Comunications-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 that 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 it 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 loose 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'.

Report=Report

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.

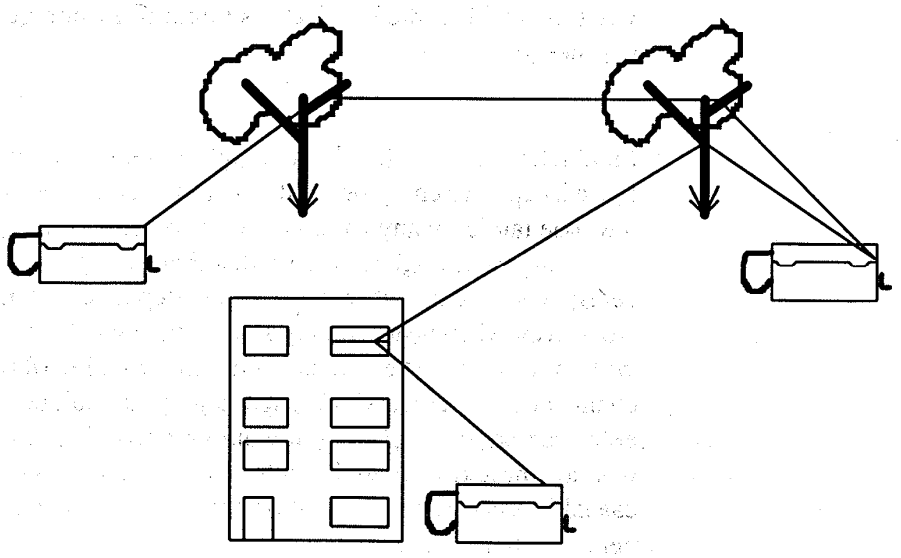


Fig 17 Field telephone systems lend themselves to improvised cabling schemes

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 rejointed 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.

=REPORT=REPORT=

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.

However the base stations are of such low power that the range of the system is only about 100M from the base station. As a result, to cover a large area my require the installation of may 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 sew 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 glamourous 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

[66] In fact they go to the trouble of arranging 'talk through' systems on their duplex base stations to give this effect.
[67] See Appendix for the full International Phonetic Alphabet.

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 unglamourous, 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 where 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.

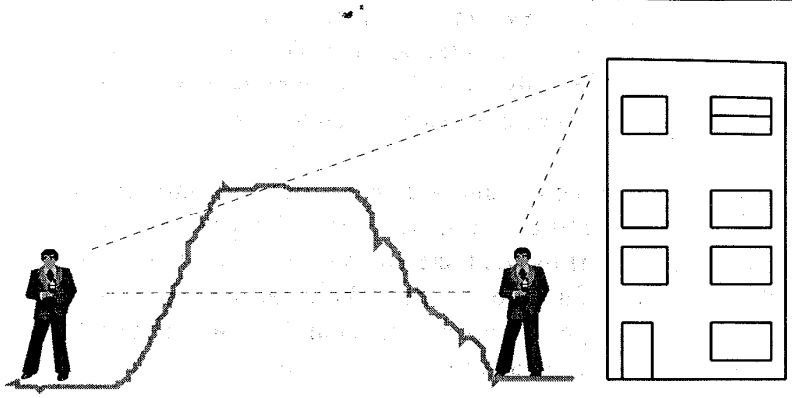


fig 18 Direct paths to handhelds can become blocked, but if you are lucky, an indirect path may also exist

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 their 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.

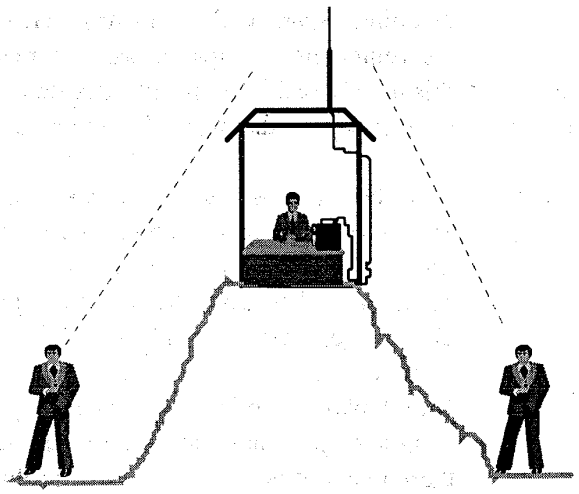


fig 19 If you can install a Base Station in a good position and have reliable manning, this is much better.

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 it's 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).

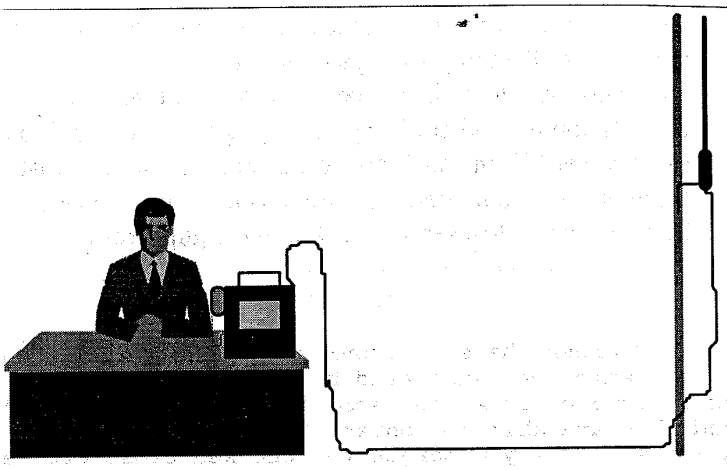


fig 20 A transportable unit should be used with an external antenna.

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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=Report=Report=

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.
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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 HM[68] 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.

[68] The antennas for Liverpool Coastguard's Marine Rescue Centre at Bootle are on top of Blackpool Tower, giving a commanding coverage of the Irish Sea.

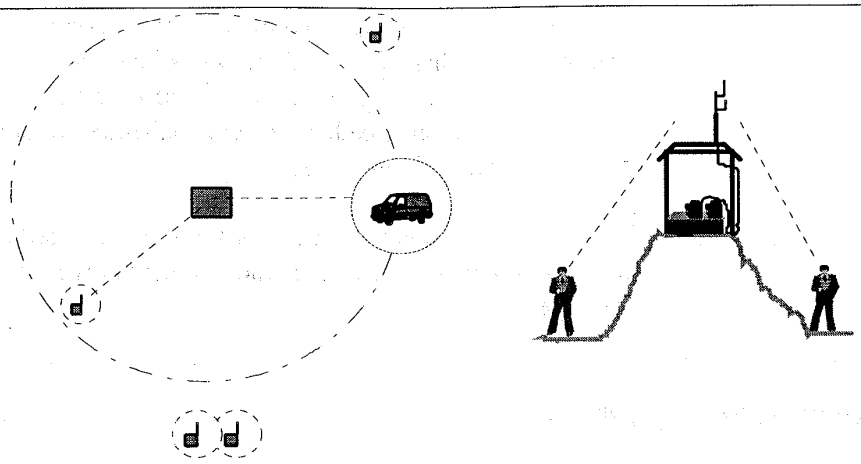


Fig 21 Repeaters boost range but need fallback schemes in case of failure

However their 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.

[69] The UNDHA portable repeater for use at a disaster site has enough self contained battery power for 24hrs sustained operation.

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 lets just take a short step back and look at how radio works.

In the days before radio, carrier pidgeons 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 handhelds 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 handhelds 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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=Report=Report=

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
handhelds 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 channel 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 handheld 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.

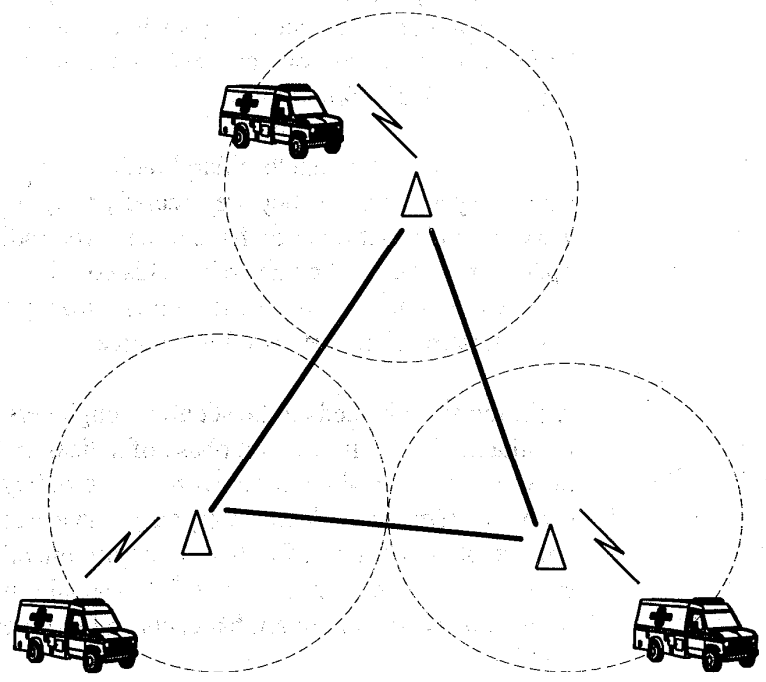


fig 22 A trunked system links repeaters together to provide a wider area of coverage while keeping operaton of the radio as simple as a simplex system. This method also retains the benifits of point to multipoint communications.

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 may 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 ionoshpere,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.

6.14 Antennas

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

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=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 time 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 guarantied 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.

DOJ EX. 1025

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 .

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=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
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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.

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=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.
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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

[70] A personal opinion, your experts may advise otherwise.

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

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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', 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

[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.

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 may 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 to 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 baring shown on the GPS screen, is the baring 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 todays 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!

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 is 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 to a Memorandum of Understanding (MoU). This is a kind of 'contract' in which you agree to use their resourses 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 Department[72] 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.

[72]The CICR have such a special department staffed by former Marine Radio Officers for this reason.

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).

Index To Disaster Communications.

1
12V, 66
12V DC, 74
2
2 stroke oil mixing, 85
2.4Kb/s, 34
220V AC, 74
24HR operation, 89
24V batteries, 66
5
56 Kb/s, 31
6
6.5 Power Output, 159
64 Kb/s, 31
A
AC power, 76
accord on disaster management, 97
account, 57
Accounts for call billing, 57
adapter kits, 87
addressee, 11, 24
administrations, 102
Admiralty list of Signals, 42
Aeronautic service, 151
Aeronautical Service, 58
Africa, 29, 51, 205
Africom, 27
aid agencies, 28
Aid applications, 89
Aid Communications, 203
Aid communications, 5
Aid organisations, 7
aid worker, 46
air time, 39
Air Traffic control Authorities, 35
Aircraft, 58
aircraft, 84
Allocations, 176
Alternative energy, 88
Alternators, 77
Amateur Bands, 105
Amateur bands, 101
Amateur Emergency networks, 61
Amateur licence, 61
Amateur Microprocesor Teleprinter Over Radio, 48
Amateur Microprocessor Teledata over Radio (AMTOR), 184
Amateur Radio, 150
Amateur radio, 42, 173
Amateur radio networks, 62
Amateur Radio Service, 60
Amateur Radio Services, 97
Amateur Service, 100
Amateur Teleprinter Over Radio., 47
ambulance, 187
Ambulance Brigade, 7
Amendments, 133
American Mobile Satellite Corporation, 36
AMTOR, 47, 48, 185
antenna, 28, 56, 153, 155
Antenna gain, 158
antenna system, 162
Antenna Tuning Unit (ATU), 49
Antenna Tuning Unit.(ATU), 178
ANTENNAS, 49
Antennas, 177
antennas, 52, 53
Arabic, 15
Army, 7
ARQ, 48
arrested, 120
ASCII, 184
ASCII character set, 185
Assisting State Party, 114
ATUs, 49
Authentic Texts and Certified Copies, 137
autoexec bat, 75
AUTOLINK, 54, 58
Automatic Contactors, 68
Automatic Dependent Surveillance (ADS), 36
Automatic repeaters, 163
Auxiliaries, 87
AX25, 181
B
back market economy, 196
back up, 180
Back-up copying, 13
Barer Network, 2
base loaded whip, 156
Base Station, 157
base station, 63, 64
Base Station Controller (BSC), 194
Base Stations, 36, 161
base stations, 147
batter, 74
Batteries, 65
batteries, 32, 70, 80, 141
battery, 159
battery back-up, 191
battery charger, 65, 76
Battery chargers, 71, 77
battery chargers, 70, 88, 89, 160
battery eliminator, 72
battery life, 190
battery power, 198
BBC, 21
BBC World Service, 55
Beacons, 46
beacons, 55
beam, 178
BEAMS, 51
bearing, 178
Beirut, 146
Benzine, 84
Blocking, 101
Bobbin type antenna, 178
Bobbin type antennas, 50
boot up, 75

DOJ EX. 1025

booting up, 13
border, 15
briefcase, 73
Broadband antennas, 178
broadcast, 149
Broadcasting, 149
broadcasting, 97
brown out, 76
BT, 29
Buenos Aires, 99, 100
built in batteries, 66
bursts, 71
C
Cables, 2
cabling, 143
Calling a coast station, 56
callout alert, 190
callout systems, 96
Callsign, 8, 152
callsign, 56
camp, 85
cannibalise, 79
carburetter, 85
carrier pidgins, 165
carrier pigeon, 46
carrier wave, 46, 165
cars, 84
CB, 45, 92, 171
CB sets, 149
Cellular Mobile Phones, 2
cellular phone, 194
Cellular Phone system, 147, 148
chain, 24
Channels, 165
charger, 69
chargers, 69
charging, 13, 24, 57
Charging Batteries, 77
Charging batteries, 65
charities, 96
chat shows, 20
checkpoint, 15
Chinese, 15
CICR, 15, 47
CICR(Red Cross), 184
circuit breaker, 78, 80
circuit breakers, 76
Circulating messages, 11
Civil Defence, 7
Clarifier, 47
Clean line, 79
Clean loads, 79
Cleanliness, 85
clearing house, 25
co-ax switching system, 52
Coast Earth Station, 28
coast radio station, 22
Coast Station, 53
coast station, 64
Coast Stations, 42
coast stations, 57
Cold Standby Redundancy, 78
colour pictures, 19
colour stills, 31
commands, 12
Commercial frequencies, 179
commercial frequencies, 105
Committee International of the Red Cross (CIRC), 94
Communicating with Emergency services, 8
Communicating with NGOs, 96
communications and disaster management, 96
Communications Department, 205
Communications on the move, 32
Communications satellites, 27
Communications while moving, 34
Competent Authorities and Points of Contact, 131
computer, 75
computer keyboard, 185
Computer Literacy, 33
computer programs, 185
Computers, 75
computers, 66, 76, 79
computers,, 70
COMSATS., 27
conference call, 39
confidence, 22
confidentiality, 63
confirmation, 24
congestion, 104
Constellation, 4
consultancy, 205
consultants, 207
Contactors, 68
Continuous Tone Controlled Squelch System (CTCSS), 186
Continuous Wave, 46
Control centre, 8
control room, 25
convention on disaster communications, 97
CONVENTION ON THE PROVISION OF TELECOMMUNICATION RESOURCES FOR D, 110
convoy, 15
Cordless PBXs, 147
CRASH, Computer, 13
crocodile clips, 66
crystals, 46
CTCSS, 187, 188
customs duties, 98
CW, 46
D
DATA, 34
Data, 30, 31
data, 32, 37, 59, 71
Data by radio, 180
data communication, 180
Data super highway, 17
data systems, 63, 175
Data terminal, 37
date and time, 23
DC device, 77
dead zone, 177
dealers, 205, 207
Decca, 199
defeat the SELCALL, 189
Demodulator, 46, 165
Denunciation, 135
Depositary, 135
desk top computer, 180
DHA, 94
diagrams, 14, 15
Diesel, 83
diesel, 77, 83
Digipeater/mailbox, 183
Digipeating, 182
Digital European Cordless

DOJ EX. 1025

Telephone (DECT), 147
dip stick, 83
diplomatic immunity, 123
diplomatic incident, 186
dipole, 156
DIPOLES, 50
DIRECT BILLING, 55
direct communication between Amateur stations and other station, 101
direct dial, 30, 33
Directional antennas, 51
directory, 22, 42
Dirty loads, 79
Disaster, 114
disaster area, 103
Disaster communications, 5, 203
disaster communications, 97
Disaster Management Team (DMT), 95
disaster management training programmes, 98
Disaster mitigation, 114
disaster mitigation, 97
disaster tourists, 118
disaster traffic, 105
Disaster worker, 65
Disaster workers, 93
Disc drives, 33
dispatcher, 21
Dispatcher systems, 38
Dispute Settlement, 132
Distribution, 86
doctors, 55
Don't Care' services, 79
downlink, 167
DRCF, 2, 4, 50, 70, 91, 96, 140, 200, 201, 205, 206
Dual Battery schemes, 68
dual standard phones, 37
DUPLEX, 57, 59
Duplex, 9, 56
duplex pair, 167
dusty, 85
Duty free shop, 83
Dynamos, 77
E
early warning systems, 96
Earth, 27
Earth Leakage breaker(ELCB), 86
earthing, 178
Echo Tests, 24
ELCB, 86
Electricity, 6
Electronic Books, 19
Electronic Mail, 17
electronic mail, 16
electronic mail system, 186
Electronic Mailing, 10, 12
electronic mailing systems, 185
Ellipso, 4
emergency call, 25
emergency mobile phone systems, 195
emergency networks, 62
Emergency services, 7
end of message, 23
entry exit and transit, 98
Entry Into Force, 133
environment, 88
Ericsson, 37
error correction systems, 185
Exemption from licences, 30
exercise, 70
Exercising, 70
experts, 22
explosion hazard, 84
extension lead, 155
extension leads, 87
external antenna, 161
External antennas, 155
external antennas, 171
external PSU, 73
F
Facsimile, 14
fall back, 181
FAX, 12, 13, 14, 16, 31, 32, 34, 43, 54, 66, 70, 74
FAX application form, 57
FEC, 48
field staff, 196
field telephone system, 30
filtering of fuel, 85
Finance, 6, 7
Fire Brigade, 7
fire Hazard, 84
Flat battery, 67
FLEET MANAGEMENT SYSTEMS, 35
Float Charging, 72
floppy disc, 13
footprint, 36
Forward Error Correction, 48
four stroke, 83
frequencies, 101
Frequencies, getting a licence, 63
frequency, 187
Frequency Shift Keying, 47
Frequency stability, 80
FSK, 46, 47
Fuel, 83
fuel, 67, 81
fuel gauge, 83
full duplex, 33, 54
Full Duplex TELEX, 30
Full Parallel Redundancy, 81
fumes, 67
fuse, 78, 87
G
gasoline, 84
GATEWAY SERVICES, 58
general coverage mode, 179
general coverage transceiver, 105
generator, 66, 76, 80, 84, 85, 141
generator area, 85
Generator Sets, 77
Generator storage, 79
GENERATORS, 81
generators, 70, 76, 77, 79
Generators siting of, 85
Geneva, 137, 186
GEO, 27
GEO (Geostationary), 27
Geostationary, 27
Global Communications, 64
Global hand-held phone, 27
global mobile phone, 199
Global Positioning System, 35
Global Positioning System (GPS), 197
Global System for Mobilecommunications (GSM), 195

DOJ EX. 1025

GLOBALSTAR, 4
Globalstar, 27, 37
Glonass, 199
GMT, 23
Goonhilly, 29
Governments, 6
governor, 83
governors, 81
GPS, 35, 37
grade of fuel, 85
graphical information, 14, 15
graphics, 19
Greetings Telex, 55
grid marks, 198
ground plane radial, 156
Ground Wave mode, 42
group call SELCALL, 189
groups, 39
GSM (Global System for Mobilecommunications), 192
GTL, 55
H
HAM radio, 42, 44
Ham radio, 60, 173
hand held, 4
hand luggage, 79
Hand Written Notes, 10
hand-held phone, 27
Handheld, 150
handheld, 105, 158, 173
Handhelds, 159
handhelds, 154, 157, 167
Handie Talkie or HT, 150
handover, 37
Handset, 150
HANG UP NOW, 57
hard copy, 11
hard disk, 13
hardware, 6
headquarters, 103
Health hazard, 114
helical counterpoise whip, 156
helically wound steel antenna, 153
HF Amateur Radio, 179
HF RADIO, 41
HF Radio, 175
HF radio, 7, 20, 58, 66, 71, 92, 146, 203
HF RADIO EQUIPMENT, 45
HF Radio Telex terminals, 17
HF radiocommunications, 204
HF radios, 20
high speed data, 31
high speed data links, 31
home made' wire type antenna, 52
Honda, 77
Host, 17
Hot Line, 145
I
ICO, 4, 27, 37
ICRC, 186
Identifying messages, 22
IFRC, 186
ignition system, 84
Import duty, 6
Import Licences, 108
important messages, 22
importing, 120
INFORMATION SERVICES, 55
ink cartridges, 14
INMARSAT, 28, 45, 106, 146
INMARSAT C, 69
INMARSAT SYSTEM, 28
INMARSAT-A, 15, 17, 30, 31, 74
INMARSAT-B, 15, 17, 31
INMARSAT-C, 17, 32, 33, 35, 73, 91
INMARSAT-M, 15, 33, 34, 69
installation, 7, 178
Instruction manuals, 70
Integrated Services Digital Network, 17
Inter working, 104
interface cables, 14
interlock box, 82
internal battery, 34
International Agreements, 131
International Convention on Emergency Telecommunications, 94
International Decade for Natural Disaster reduction (IDNDR), 201
international disaster communications, 99
International Maritime Satellite Organisation, 28
international phonetic alphabet, 152
International Red Cross, 15
International Red Cross/ Red Crescent, 47
International Roaming, 195
International Telecommunications Union, 100
International Telecommunications Union (ITU), 93, 115
Internet, 19, 181, 183, 200
Internet Electronic Mail, 17
Interworking, 62, 166
interworking, 173, 179
interworkng, 172
inventory number, 121
Invertor, 74
invertor, 74, 76
Invertors, 71
Ionosphere, 42, 57, 171
IRIDIUM, 4
Iridium, 27, 37
ISDN, 17, 31
Isolator switch, 67
ITU, 60
ITU Geneva convention 1979, 61
ITU Resolution 640, 100
ITU World Telecommunications Development Conference Buenos Aires, 99
J
Jamming, 92
jamming, 172
Jerry cans, 84
journal, 15
Journalists, 21
journalists, 185
K
Kawasaki, 77

DOJ EX. 1025

keyboards, 12
knives, 87
Kyoto, 1994, 100
L
LAN, 19
Land Earth Station (LES), 28
Landline, 2, 41
landmarks, 197
Lap Top, 13
Lap Top Computer, 32
Lap Top computer, 180
Lap top PC's, toughness of, 33
Laptop, 33
laser printers, 14
latitude and longitude position, 197
Lead Acid batteries, 67
Legal Issues., 91
LEO, 27
LEO (Low Earth Orbiting), 27
LEO satellite, 27
LEOs, 36
LEOsat, 197
LES, 28
Licence, 106
licence, 29, 63, 91, 152
Licences, 7, 64, 204
licences, 101, 176
licensed software, 13
licensing, 6
lighting, 86
Line extenders, 193
line of sight, 154
load, 81
Load Splitting., 78
Load, observing, 80
Local communication, 44
Local Area Netowrk (LAN), 13
Local Area Network, 17
Local Battery system, 140
Local Copy, 15
local interference, 52
LOCAL mode, 207
Local or Tactical communication, 3
log book, 83
log books, 24
Logbooks keeping, 23
logistical matters, 63, 175
Logistics, 22
logos, 19
Long Wire antennas, 178
Loop antennas, 51
Loran, 199
low budgets, 28
Low Earth Orbiting, 27
Low Earth Orbiting Satellite (LEO), 183
LSB, 47
M
Ma Bell, 2
Magneto handle, 140
mail server, 183
mailbox, 18
Mailboxes, 183
mailboxes, 184
main frequency, 56
MAINS, 81
mains, 75
Mains AC power, 74
mains electricity, 100
Mains Failure, 76
mains frequency, 80
Mains power, 2
mains power, 31
maintain, 70
Maintenance, 69
maintenance, 70
manual, 79, 85
manufacturers manual, 85
maps, 14, 15, 19, 197
maps and charts, 196
Marine frequency, 59
MARINE RADIO, 53
Marine Radio, 42
Marine radio, 151
Maturity of trafficking, 22
mayday call, 196
mean time between failures (MTBF), 206
MEDICAL SERVICES, 55
memories, 75
MES, 28, 30
message bureau, 54
message number, 22
message pager, 37
message pagers, 190
messages Trafficking of, 22
Mobile antennas, 51
Mobile Communications, 20
mobile control rooms, 8
Mobile Earth Station (MES), 28
mobile phone, 27, 33, 36, 37
mobile phone sector, 192
mobile phone service, 194
Mobile Phone system, 148
Mobile Phones, 2, 41, 193
mobile phones, 4, 39, 100
Mobile Stations, 158
Mode A, 48
Mode B, 48
model agreements, 117
MODEM, 12, 14
modem, 17, 30
Modulation, 165
modulation, 46
Modulation Modes, 46
mopeds, 84
Morse code, 42
Mosaic, 19
motor vehicle, 66
Motorola, 37
Motorola Corporation, 148
Moving communications while, 34
Moving, communicating while, 20
Moving, communications while, 32
Multi-Band, 50
N
narrow band, 52
national regulations, 104
national security services, 107
natural disaster, 100
Natural hazard, 114
Net Controller, 151
Netscape, 19
Network, 24
network, 8, 24
networking, 25
Networks, 6, 7, 8, 20
News organisations, 21
newspaper report, 186
NGO's, 39

DOJ EX. 1025

NiCad battery, 69, 71
Nickel Cadmium batteries, 69
noise, 67
Noise of generators, 85
Nokia, 37
Non Governmental Organistaion (NGO), 4, 140
non-Amateur stations, 103
Non-Governmental Organisations (NGOs), 96
Notification, 192
Notification of delivery of message, 32
notification procedures, 101
Number of words, 23
O
Odysey, 27
Odyssey, 4, 37
off line, 12, 32
Omega, 199
On Site Operations Co-ordination Center (OSOCC), 95
On site Operations Co-ordination centre, 25
open channel systems, 39
operating manual, 29
Operational Co-ordinator, 115
Operational Coordinator, 136
operational coordinator, 115
Organisational barriers, 97
organiser, 8
OSOCC, 25
over', 151
overcharging, 71
overload fire, 86
overloaded, 101
overnight charge, 89
ownership, 120
P
P.R.set, 149
Packet, 180, 185
Packet data, 27, 48
Packet radio, 181
packet radio, 63, 175, 183, 200
Pactor, 185
pagers, 96
Pagers (Beepers), 190
Paging base stations, 191
paging centre, 191
paging frequency, 192
Paging list, 191
PAKTEL, 59
Paktor, 48
Palace du Nations in Geneve, 25
paper, 14, 16
party line, 151
Path-finders, 25
PAX, 140
payment for communications services, 98
Payment or Reimbursement of Costs or Fees, 124
PC, 32, 33, 47
Peak Load, 73
peak load, 78
Permanent cabling, 143
permanent licence, 104
personal calls, 55
Personal Computer, 13, 32
Personal computer, 65
personal computer, 11, 17, 35
Petrol, 83, 84
petrol, 77
Phone, 29, 31, 37
phone, 9
phone call, 22, 53
PHONE CALLS, 54
Phone calls, 9
phone calls, 24, 42
phone line, 30
Phone patch, 58
Phone patches, 146
phone system, 100
PHONETEX, 54
Phonetext, 203
phonetic alphabet, 152
photocopier, 15
photos, 14
pictures, 15, 19
pigeon, 46
piracy, 38
Pirates, 92
plain language, 63, 175
Plain Old Telephone System (POTS), 2
plain paper FAXes, 16
Planning, 6, 7, 203
PLMN, 2, 195
plug and socket, 87
Polar Regions, 29
polarising battery, 141
Police, 7
political problems, 34
Political problems INMARSAT, 29
portable, 74, 84, 203
Portable battery packs, 68
portable electronic equipment, 66
Portable Faxes, 16
portable operation, 14
Portable radio, 149
Portishead, 55
PORTISHEAD RADIO, 42
Portishead Radio, 13, 53, 180, 203
Portishead radio, 48, 51, 56, 58, 105
Position finding, 37
Position finding systems, 196
position fixing, 197
Post and Telecommunications administration, 106
POTS, 2
Power, 65, 203
power, 16, 20, 33, 34, 54, 65, 75, 88
Power Banks, 68
power budget, 74
power budgeting, 65
power cables, 143
power outage, 75
power rating, 72
power supply system, 14
Power Supply Systems, 70
Power Supply Units, 71, 72
practice emergency networks., 104
Preamble, 22
preamble, 23
President Clinton of the USA, 17
Press To Talk, 151
press to talk, 59

DOJ EX. 1025

prime mover, 77
PRINTER, 14
printer, 181
Printer Driver, 14
printers, 66, 70, 74
Priorities, 10
priority', 153
privacy, 187, 188
Private Automatic Branch eXchange (PABX or PBX), 145
Private Automatic Exchange, 140
Private Automatic eXchange (PAX), 145
private frequencies, 186
Private HF radio networks, 63
Private Mobile Radio Licence, 165
private paging system, 191
Private wire, 145
private wire, 162
Privileges, Immunities, and Facilities, 121
Procedures, 150
Project 21), 30
protection earth, 86
protocol, 134
Provision of Telecommunication Assistance, 117
Provisional Application, 133
PSTN, 2, 8, 9, 12, 33, 41, 43, 54, 56, 145
PSU, 72, 73
PTC-2, 186
PTT, 151
Public Land Mobile Network (PLMN), 2, 148, 194
Public Switched Telephone Network (PSTN), 2
Q
QRT, 103
QSY, 103
quality supervision, 205
quick charge, 71
R
R/T or R/T set, 148
RACES, 62
radar surveillance, 36
Radio Amateur Civil Emergency Service (RACES), 62
Radio Amateur Exam., 60
radio checks, 154
Radio Hams, 92
radio inspectors, 102
radio law, 60
radio licence, 191
radio manufacturers, 89
RADIO MEDICAL SERVICES, 55
Radio Officer, 204
Radio Officers, 7, 53, 92
Radio Operator, 44
radio operator, 44
Radio Operators, 7, 45
radio operators, 64
radio spectrum, 92
radio technician, 205
RADIO TELEX LETTER, 55
Radiocommunications Agency (RA), 104
radome, 29
Rating, 78
ratings, 89
RCB, 86
re-fueling, 83
React, 172
real time, 11
rec team, 196
Receiver, 45
receiver selectivity, 52
Recharging, 159
Red Cross, 96
Redundancy strategies, 78
reformatted, 13
Refugee camp, 7
Regional satellite systems, 36
registered charity, 4, 140
regulation barriers, 100
Regulatory Barriers, 128
regulatory barriers, 97
relative positioning, 197
Relay Stations, 163
relief operations in connection with natural disaster, 102
Remote basestations, 168
remote controlled Base station, 162
repair, 6
repeater, 167, 182
Repeaters, 172
repeaters, 167
Requesting State Party, 114
requesting state party, 118
rescue teams, 196
Reservations, 134
Residual Current Breaker (RCB), 86
Resolution 510, 102
Resolution 640, 61, 104, 105, 174, 179
resolution 640, 174
resonant, 49
revertive calling, 188
RIT, 47
Roaming agreemen, 195
Rotators, 51
round table, 20, 151
Royal Signals Regiment of the British Army, 96
rubber duck, 153
S
Safety, 196
sandy, 85
SATCOMS, 27
Satellife, 27
satellite, 27
Satellite Dialling codes, 29
Satellite Dispatcher systems, 38
Satellite Packet Radio, 183
Satellite paging, 192
SATELLITE SYSTEMS, 27
Satellite Terminal, 65
Satellite terminals, 20, 66
satellite up link channel, 92
Scanning receivers, 179
scheduled reporting times, 22
scramble, 63, 175
screens, 12
screwdrivers, 87
Security, 86
security, 20
Security Back-up, 13
security problem, 156

DOJ EX. 1025

SELCALL, 188
Selcall, 188
selectivity, 52
SEMI-DUPLEX, 57
SEMI-FAX, 12, 16
Semi-Fax, 13
Semi-Permanet cabling, 143
sender, 10
sergeant Bilko, 196
Serial Number of message, 22
Servers, 19
service tank, 83, 84
Setting up equipment, 11
settings, 75
Ship Earth Station, 28
ships, 28, 42
Short message service (SMS), 192
Short range communications, 3
short term disaster relief organisations, 97
short term use, 101
Short Wave radio, 42
signatures, 15
SIMPLEX, 59, 151
Simplex, 9, 20, 59
simplex, 167
simplex radio system, 187
Simplex teleprinter over radio, 48
Simplex Teleprinter over Radio (SITOR), 184
Single Side Band, 47
Single Side Band (SSB), 42
Siting of generators, 85
SITOR, 47, 59
sked, 9
Skeds, 22
skip, 171
skip zone, 177
Sky Wave, 42
Slim Jim, 156
smoothing circuit, 77
software, 47
Solar Panels, 89
Sound baffle, 85
space, 27
space launcher, 38
spare battery, 160
spark plugs, 84, 87
specification book, 81
specifications, 107
spectrum, 92
Sponsors, 3
spreadsheets, 185
SSB, 42, 46, 47
St.John Ambulance brigade, 187
Standby Generators, 78
Store and Forward, 33
store and forward, 56
Store-And-Forward, 32
Storing generators, 79
subscription, 194
Sun 11 year cycle, 171
survey, 107
Surveying, 7
Swiss Disaster Relief organisation (SDR), 94
Swiss-PTC, 185
synchronised., 81
synchroniser, 81
Synthesizers, 46
system disc, 75
System integration, 204
Systems Integration House, 205
T
Tactical, 3
Tampere, 99
Tampere declaration, 96
tanks, 84
Tapping off required voltage, 66
tariff structure, 98, 99
Technical Co-ordinator, 115
Technical Coordinator, 137
technical coordinator, 115
technical fault, 25
technician, 205
Technicians, 8
Telecommunication Assistance, 119
Telecommunication assistance, 114
Telecommunication Assistance Action Plan, 128
Telecommunication resources, 114
Telecommunication Resources Inventory, 127
Telecommunications (definition), 114
Telecommunications for Disaster Mitigation and Disaster Relief O, 100
telecommunications resources, 115
Telecopier, 14
Teledesic, 4
telegram, 10, 22
Telephone, 30
telephone exchanges, 100
telephone line, 193
telephone line private wire, 191
telephones, 140
Teleprinter Over Radio, 47
Teleprinter Over Radio (TOR), 47
Teleprinter Over Radio (TOR), 184
Teleprinter Over Radio systems (TOR), 42
TELEX, 12, 17, 29, 31, 32, 33, 41, 47, 54, 55, 56, 59
Telex, 2, 10, 11, 43, 48, 54
telex, 100
Temporary cabling, 143
terminal, 33
Terminal Node Controller, 47
Terminal Node Controller (TNC), 182
terminals, 13
Termination of Assistance, 123
TERRESTRIAL SYSTEMS, 41
Testing, 5
testing, 70
TEXT, 12, 32
Text, 10
text, 22, 33, 47
text message, 13
Text messages, 10
The depositary, 115
The Disaster Relief Communications Foundation,

4, 140
third party, 62
time, 197
Time Zone, 54
Time zone, 11
Time Zones, 10
TIR, 108
TNC, 47, 183
tone alert, 190
tools, 79, 87
TOR, 42, 47, 54
Tor, 180
Tracking messages, 22
tracking system, 29
Traffic, 21
traffic dispatcher, 21
traffic list, 56
trafficking, 22
Trafficking messages, 22
Training, 5, 7, 81, 200
training, 33, 57
training programmes, 98
transboundry co-operation between states., 100
Transceiver, 45
Transformers, 87
Transit, 199
Transit of Personnel, Equipment, Materials, and Information, 126
Transmitter, 45
transmitters, 53
Transport plane, 5
Transportable, 149, 158
Transportable units, 160
transporting the fuel, 84
traps, 50
Trickle Charger, 71
truck, 84
Tuned antennas, 50
Tuner,, 165
TURNKEY, 205
Turnkey contracts, 204
Twisted Pair, 2
two stroke, 83
Two stroke engines, 85
Two-way radio, 148
Type approval, 177, 178
type approval, 60, 108
type approvals, 101
Type approved, 93
U
UHF, 44, 105
ultra high frequency, 44
un attended, 20
UN Department of Humanitarian Affairs (DHA), 115
un-attended, 184
unattended, 11
Unattended operation, 54
UNDHA, 94
UNDRO, 98
UNHCR, 186
Uninterruptable Power Supplies, 75
United Nations Department of Humanitarian Affairs, 25
United Nations Department of Humanitarian Affairs (UNDHA), 94
United Nations Development Programme (UNDP), 95
United Nations Disaster Assessment and Co-ordination team (UNDAC, 95
uplink, 167
UPS, 76
UPS's, 75
Urgent priority, 23
US dollars, 83
User service, 174
Users, 7
Using HF radio, 55
UTC, 23
V
vehicle, 66
Vehicle batteries, 66
vehicle batteries, 32
VERTICALS, 50
very high frequency, 44
VHF, 7, 44, 105
VHF repeater networks, 39
vibration alert, 190
video, 30
video phones, 17
VIP, 123
VIRUS, 13
voice check, 181
voice communications, 9
voltage regulator, 77
Voltage regulators, 76
voltage regulators, 71
voltmeter, 87
Volunteers, 5
W
waiver of charges, 99
Walkie Talkie, 147
walkie talkie, 70
Walkie talkies, 141
walkie- talkies, 44
walkie-talkies, 140
war zone, 102
waveform, 74
WAYPOINT, 198
Where There Is No Telephone, 107, 176, 178
wideband, 50
Widebanders, 50
wind, 88
Wind turbine siting, 89
Wind Turbines, 88
wire cutters, 87
wire type antenna, 52
wires, 141
Wires, hazards of, 86
wiring overhead, 86
word processor, 16
working frequency, 104
Working Group on Emergency Telecommunications (WGET), 94
Working groups, 93
World Administrative Radio Conference (WARC), 100
World Memorial Fund, 25
World Wide Web, 19, 200
WWW, 19
WWW Servers, 19

DOJ EX. 1025

Appendix Table of contents.

1) DRCF, who and what we are.

2) United Nations Department of Humanitarian Affairs.

3) Summary table of portable communications equipment.

4) Main elements of emergency communications (matrix).

5) Emergency telecommunications Annotated Bibliography.

6) Tampere Declaration.

7) Volunteers in Technical assistance.

8) Portishead Radio.

9) INMARSAT.

10) Tor E. Wisloff's tabulated overview of Big LEOs.

11) How HF radio works, a tutorial.

12) To what extent is the normal public cellular phone system of use in a disaster situation? An essay.

agencies such as the International Red Cross (ICRC). Pro-active and un-coordinated aid teams are not wanted; they may themselves add to the problems inevitable in a disaster area. The keynote of the DRCF operation is cooperation.

Equipment

Each team takes with them HF (short wave) radio *transceivers* (transmitters which can also receive, thus permitting conversation) for long range communication across the world. They can work any frequency, whether commercial, military, diplomatic, ham, marine, air, or special frequencies such as are used by the International Red Cross in Geneva. They can use various modes of transmission including voice, morse code, and digital modes. For the latter they take computers so that messages can be typed (overcoming language and pronunciation problems which can occur with voice) and there is a printed record at each end of the connection by radio.

The teams are also equipped with satellite radio transceivers. These afford communication anywhere in the world between 70 degrees north and 70 south, day or night and regardless of weather conditions. It is identical to the equipment fitted to ships on the oceans of the world and, as for the HF radios, has its own portable computer, printer etc. The main purpose for including it is to give access to the vast international telex network. The satellite equipment can also communicate direct with any ship or shore station which has the same gear. They also take a global position system, accurate to 30 metres anywhere.

The DRCF team has both petrol and diesel generators to enable them to run on whichever fuel is available locally. They take a frame tent, tables etc so that a message handling office can be set up wherever they are to serve the needs of any aid agencies in the area; priority is given, of course, to the agency which called them out in the first place.

Formation and Charitable Status

The DRCF was formed by a Deed of Trust dated 18th September 1989 and was registered as Charity Number 802122 on 20th September.

Financial Appeal

Although the DRCF has been equipped, by purchase, gift and permanent loan, sufficiently to enable it to perform its function, funds are needed for more gear to make it efficient and to support the organisation. For example, telephone and postage is still paid for privately; insurance of its operators is far from ideal and modest sums are required for training.

In addition to donations, which are very welcome to pay for necessary equipment for the teams, the DRCF is looking for an assured income of £2,000 a year for the next three years. All donations and covenants are promptly and gratefully acknowledged.

Further information is available from:

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THE DISASTER RELIEF COMMUNICATIONS FOUNDATION

Trustees
Admiral Sir William Pillar GBE KCB
Commander Charles Thomson MBE RN
John Thomson Esq.

Director
Lieutenant Commander David Row RN

Registered Charity Number 802122

230/298

DOJ EX. 1025

What We Are

The DRCF - *Disaster Relief Communications Foundation* - is a British charitable trust for international disaster relief mainly by radio. It is a voluntary public service funded entirely by donations.

The object of the Trust is to provide immediate emergency communications, on humanitarian grounds, for the rescue and relief of those struck by disaster, anywhere in the world and without consideration of race, colour, politics or religion.

The DRCF is a British contribution to the international disaster relief resource.

Why We Started

The DRCF was started to fill a need which became apparent in wake of the Armenian earthquake in 1989. In the immediate post-disaster stage David Row, amateur radio callsign G0EUE, from his home radio station in England assisted in passing the heavy radio traffic between the USSR and the USA.

His enquiries revealed that the field teams of specialist rescue workers, doctors etc, had no effective communication back to their base in the UK (some rescuers, who had taken communications equipment with them as an adjunct to their main function, were unable to use it). This was not just a British problem; the teams from other countries were similarly handicapped. There was no specialist communications team on site. Clearly there was a need for such a vital supporting service: hence the DRCF.

The need was amply confirmed at the International Conference on Disaster Communications in Geneva in March 1990 which was attended by the Honorary Director of the newly formed DRCF at the request of the United Nations Disaster Relief Organisation (UNDRO).

Membership of the DRCF

The DRCF was set up to provide and equip volunteers who are qualified professional radio operators who also hold full amateur radio licences. Amateur radio, or *ham radio* as it is often affectionately called, is in many countries part of their official disaster preparedness plans; hence its importance to the DRCF.

The heart of the DRCF is, of course, its field operators. All are volunteers. They are selected almost more for their personal qualities than for their technical abilities - which latter are not inconsiderable.

They need to be self-reliant and "street wise", good team members and sensitive to the ways of aid workers, officials and local people of other nations.

Their experience is varied and wide. For example, one was a radio operator with the British Antarctic Survey. Later he needed considerable resourcefulness then he was up country in Lybia when the Americans bombed Gaddafi. He found his way out - not through the front door. Several DRCF operators hold merchant service General Certificates in Radio Telegraphy or the service equivalent; one is a serving naval officer.

They have an assortment of skills outside communications. All hope to acquire a full first aid qualification; one has done the ambulance aid course. Another holds a private pilots licence, gained during his experience in the bush in Africa. One holds a large goods vehicle (formerly HGV) licence for articulated vehicles - and so on.

We have been most fortunate in the quality of our people, not least in the understanding shown at home and by their employers. Although not a requirement, they are all in jobs, married and raising families, well supported in their DRCF activities by their wives. The motivation of our operators is quite straightforward: they have certain skills which they have offered to use to help others.

The DRCF Field Teams

The DRCF provides rapid-response teams of two operators, working on the *buddy pair* principle (equally trained and each responsible for the safety and welfare of the other).

Our aim is to be at the disaster site within twenty four hours of a call-out. This aim is set to match that of the United Nations disaster asssesment officers.

Depending on the logistic circumstances at the time, the pairs are self-contained with everything for two weeks except water (they have personal water purifiers), fuel (because you cannot fly with fuel) and transport (because the climate, terrain, and local facilities at the next disaster are unknown).

The assignment period of up to two weeks is set in the expectation that by that time major international relief effort will have started to build up and the need for rapid-response teams should have ended.

The DRCF is a responding organisation; it only sends its rapid-response teams into the field when their services are requested. This is strictly in compliance with the general requests of the British government and of major aid

231/298

DOJ EX. 1025

Emergency Telecommunications with and in the Field during Acute Emergencies

DHA Project DPR 121 (29-4)

Introduction

The need for reliable telecommunications during acute emergencies has been recognized ever since the creation of the Office of the United Nations Disaster Relief Co-ordinator, and in 1991 UNDRO convened a first conference on the subject. The co-ordinated way towards a facilitation of telecommunications for humanitarian assistance was defined by the 1992 Conference of Declaration of Experts on Disaster Communications in Tampere, Finland, co-hosted by UNDRO.

In 1994 the regulatory aspects of the use of telecommunications during emergencies were the subject of two resolutions of the International Telecommunications Union; Resolution No.7 of the World Telecommunications Development Conference of the International Telecommunication Union (ITU), which contains the 1992 Tampere Declaration as an annex, and Resolution COM4/14 of the ITU Plenipotentiary Conference (Kyoto, 1994). With these resolutions the issue has reached the highest level within the ITU, which does not have a mandate for the creation of an international convention as proposed in the Tampere declaration and in the above resolutions.

As a second sector, the project covers the operational co-ordination of emergency telecommunications during the acute phase of an emergency. In as far as the own emergency telecommunications capabilities of DHA are concerned, the UNDAC and OSOCC projects of DHA are being provided with the necessary telecommunications equipment and services to ensure their self-sufficiency.

The Scope of the Project and its Links to other on-going Activities

The overall terms of reference for the project as well as its interfaces with other activities have been defined by the first meeting of the WGET. An overall matrix of the elements of emergency communications and information for DHA as a whole and covering disaster mitigation, disaster response and information management was established (copy attached). The DHA project on Emergency Telecommunications is focusing on response during acute emergencies and its main links to other projects can be listed as follows:

- The Thin-Route Network Working Group, convened by the UN Secretariat, deals with the establishment of UN telecommunications networks in regions which do not have sufficient public telecommunications links, frequently in regions affected by longer-term, complex emergencies. The equipment and modes of communication used for the network are at least at the present time not suitable for use during the

.../2

acute phase of an emergency; the actual communications costs are however considerably lower than those for the use of the fully portable equipment deployed during the initial response phase. The means provided by the Thin-Route Network should therefore replace those of rapid response at the earliest appropriate time. One regulatory aspect of this network, its shared use including non-UN partners in humanitarian relief operations, is, to the extent that it relates to the proposed convention, considered by a team within the WGET Sub-Group on regulatory issues. This team is led by UNHCR as the leading agency in the Thin-Route Network Working Group.

- The UN Back-Bone Network, administered by the Electronic Services Division of DAM at UN Headquarters in New York, is a permanent carrier for traffic among major UN offices. In respect to Emergency Telecommunications as dealt with under the project it has the same position as public networks, i.e. compatibility has to be ensured through appropriate technical interfaces. The UN Department of Administration and Management is, through the UNOG Electronic Services Section, participating in the WGET.

- The content of the information carried on emergency telecommunications links is not covered by the project. It is the subject of the proposed "ReliefNet" initiative, under the responsibility of the Information Management and External Relations Branch (IMERB) of DHA. The designers and users of electronic information systems are however represented in the WGET, so that full consideration can be given to their requirements regarding the exchange of information with the field during the acute phase of an emergency. In fact in most of the WGET member organizations the same units or persons are dealing with information systems and telecommunications matters.

The Status of Implementation of the Project

The United Nations, and in particular the Department of Humanitarian Affairs (DHA) which represented the UN in both above ITU conferences, has by the resolutions been entrusted with the further follow-up. The facilitation of emergency relief operation is, under the mandate given to DHA by GA Resolution 46/182 and following resolutions, an element of Relief Co-ordination. The facilitation of emergency telecommunications is closely linked with disaster mitigation as well as with the development of information systems, a fact which is recognized in the above ITU resolutions, and while the Relief Co-ordination Branch (RCB) of DHA is in charge of the project, the work is being carried out in close collaboration with the IMERB, the Disaster Mitigation Branch (DMB) and the Secretariat of the International Decade for Natural Disaster Reduction (IDNDR).

.../3

An informal Working Group on Emergency Telecommunications (WGET) has been convened by DHA in November 1994; this group and in particular the WGET Core-Group (as a steering committee) ensure the full representation of the interests of all UN agencies as well as other institutions, including NGOs, the ICRC and representatives of academic institutions involved in humanitarian assistance. The WGET has held a second meeting in February 1995 and several sub-group meetings. DHA is acting as the secretariat of the WGET, the sub-groups are led by facilitators from DHA, UNHCR and the Swiss Disaster Relief Unit respectively.

In 1994 the project was funded from an earmarked cash contribution of the Swiss Disaster Relief Unit (SDR). This enabled in particular the initial research on a comprehensive documentation on regulatory and legal issues related to the future Convention on Emergency Telecommunications which was, together with an annotated bibliography, submitted to the WGET. The contribution also allowed the preparation of the meetings of the WGET.

Further Implementation of the Project

In order to ensure that the project serves the actual needs of those who are to benefit from it, the project is being implemented in close cooperation with and under the guidance of the WGET and its Core-Group. The working group and its sub-groups are holding regular meetings, the third informal WGET plenary meeting being scheduled for May 1995.

For the funding of the project, a submission for its inclusion into the extrabudgetary activities of DHA has been made. In addition SDR has been approached for a continuation of its support and additional potential donors are presently being approached as well. This support is required for the provision of temporary assistance / consultancies for the work on the regulatory issues, in particular for the preparation of the proposed intergovernmental conference in 1996. This conference can only succeed, if a general agreement of the necessity and the acceptability of a convention can be obtained well in advance, and national telecommunications authorities have to be informed and consulted for this. At the same time, the project has to be presented in appropriate events, most of all the TELECOM 95 conference and exhibition (Geneva, October 1995) but also in other events dealing with either disaster relief or telecommunications issues. At the same time, a host country for the 1996 conference must be identified.

As an effective means to ensure the full participation and support of all interested groups it is intended, to hold one of the next WGET meetings within the framework of a larger workshop on emergency telecommunications; possibilities to hold such a workshop in a location which would allow intensive participation from a frequently disaster-affected region with extensive experience in regional cooperation are being evaluated. This will in particular help to avoid duplications and overlapping

.../4

with activities from other sides, including the academic and the commercial sectors where the subject of emergency telecommunications finds increasing interest. It is intended, to mobilize contributions from commercial sponsors; this however requires the identification of a suitable workshop organizer, as the UN can apparently not accept such contributions. Regarding the legal aspects of the forthcoming intergovernmental conference, the UN secretariat will on the appropriate level be consulted regarding the appropriate procedures. The project will be included in the report to ECOSOC and it is likely, that it will have to be brought to the attention of the 1995 General Assembly in the report on DHA and/or through a proposal for a resolution by a member state.

The second sector of the project, i.e. the improvement of the own capabilities of DHA for emergency telecommunications during relief operations, is being followed up within the RCB. It is closely linked to the UNDAC and OSOCC concept, involves MCDA as well. Concerning the content of the information to be exchanged with the field during an acute emergency, the technical requirements to carry such data are to be defined by the IMERB. The acquisition of additional equipment will, as before and to the extent possible, be funded from resources available to the actual users (UNDAC, OSOCC) and from contributions for specific relief operations.

Hans Zimmermann
14 March 1995

Summary Table of Portable Communications Equipment for Use by DHA in the Initial Phase of an Emergency

Type and Range	Equipment	Cost and Weight	Remarks
VHF 3-25 km (depending on terrain and on antennas)	Hand-held or mobile units, the VHF Kit developed by DHA contains 6 hand-held and 2 mobile/base units, antennas and accessories.	400 - 700 $ per radio (DHA VHF Kit complete: US$ 5'000, 48 kg)	For on-site co-ordination and individual communications for safety and security of field personnel. Range depends on terrain. Under evaluation: VHF "wireless LAN" between field offices.
VHF (with repeater) 20-50 km and more	Equipment as above, in addition a Repeater Station, to be placed in the highest accessible location.	Cost of radios as above, a repeater station costs US$ 4'000, 50 kg	As above, but with a wider range; DHA has developed a self contained repeater station in a weatherproof case and with built-in batteries for 48 hrs.
HF (shortwave) (voice) regional to world-wide	Portable ("manpack") and mobile stations (not much bigger than a car radio) and base stations. Range depends on antenna used.	Typically US$ 2'000, no communications fees, 2 - 10 kg plus power supply	Commonly used for regional communications, 50 to 1'000 km, No communications fees unless used for connections through commercial land-stations.
HF (shortwave) (data) regional to world-wide	Base stations including modem for SITOR / PACKTOR, laptop computer and power supply (battery and charger), antenna.	Typically US$ 5'000 no communications fees, incl. modem and laptop 5 - 15 kg	Reliable data links with similar stations world wide need a qualified (locally trained) operator. No communications fees, unless messages are routed through commercial land-stations.
Satellite Terminal Inmarsat Standard C world-wide telex, data and (send-only) fax links	Terminal in a suitcase, including laptop computer, printer and omnidirectional antenna, limited autonomy (up to 4 hours stand-by) from built-in battery, then power is required from a generator or a car battery	Typically US$ 4'000, communications fees similar to those for regular telex, but calculated per byte rather than by time, 15 kg	Sends messages to any telex or fax machine, receives messages from any telex machine or C and A terminals. Via certain Land-Earth Stations Standard C terminals Can also send and receive data / e-mail. Storage-and-forward system only, real-time dialogue is not possible.
Satellite Terminal Inmarsat Standard A world-wide phone/fax/telex/ data links	Basic terminal, for phone links only, with parabolic antenna, in one suitcase, accessories (fax, power supply for use with car battery etc.) in a separate accessory box of 30 kg).	Typically US$ 40'000 for a complete station, communications fees (phone and fax) US$ 6.- to-10.- per minute (!), 20 kg	Full phone and fax capability, telex with laptop, high-speed-data capability optional. Standard A terminals are expensive to purchase and to operate, but the fastest means to establish reliable phone and fax links with the field in the initial phase of an emergency.
Satellite Terminal Inmarsat Standard M World-wide phone and (limited) fax links	Attaché-case, complete for phone communications, powered from generator or car battery, flat antenna in lid of case, portable telefax machine in a separate attaché-case.	Typically US$ 12'000, communications fees lower than for Standard A: US$ 3.- to 5.- per minute, 10 kg	Digital voice communication with narrow bandwidth over public phone network; fax slow (2400) and not compatible with all machines. Operational since late 1993 but not yet supported by all land earth stations. Quickly installed and very easy to use.
Satellite Terminal Inmarsat Standard B Same as Standard A, but digital communications mode	Digital version of the Standard A terminal, lower power consumption, smaller and easier to install antenna, some makes and models will offer high speed data links and multiple phone and fax lines (with field PBX) as options.	Purchase price and communications fees are expected to be lower than for Standard A, weight and dimensions similar to those of the Standard A terminals	To be fully operational 1995 and expected to partially replace Inmarsat A, offers better security and privacy of communications due to digital mode. Standard B will in the future also serve as the intermediate stage between Inmarsat A (quick response) and the Thin-Route Network (VSAT, for longer term use).

Prices indicated are approximate as per December 1994, in particular for satellite terminals there is a tendency towards lower prices for equipment and further efforts to reduce communications fees for humanitarian organizations are being undertaken.

MATRIX
OF THE MAIN ELEMENTS OF EMERGENCY COMMUNICATIONS & INFORMATION

	MITIGATION (PRE-DISASTER)	INFORMATION MANAGEMENT (PERMANENT)	RESPONSE (POST DISASTER)
Public Networks	• Information Exchange • Survival and recovery capability of networks	• Routine Telecommunications (Phone, fax, telex, data) • Access to data networks	• International links • Local / regional links (if available) • Distribution of reports
Satellite Telecom-munication	• Local / regional data collection, data transmission for remote sensing	• UN Backbone Network • UN Thin-Route Network • Permanent digital links	• International links from disaster site • Backup for regional and international links • Transition from initial response to Thin Route Network links
HF & VHF Radio Com-munication	• De-centralized means of telecommunication with high survival capability • Frequency allocations for humanitarian needs	• Interface between emergency telecommunications and routine systems	• Regional and local emergency telecommunications links • Backup for international links
Regulatory and political Issues	• Facilitation of the use of de-centralized means of telecommunications and of data collection links • Collaboration with IDNDR projects containing telecommuni-cations elements	• Licensing of land stations for UN backbone network and connections to public networks	• Transborder use of emergency tele-communications equipment • Facilitation of emergency tele-communications for NGOs including their participation in UN networks
Satellite Observation	• Monitoring • Early Warning • Scientific applications (research)	• Access to and maintenance of data bases / images	• Post-disaster data (high resolution images), • Future real-time information
Data Processing	• Maintenance of data bases • Linking of data bases	• Access to data bases • Humanitarian Information Management Systems and Networks	• Data collection in the field • Access to HQS and outside data bases
Public Information and Media	• Creation and upkeep of public awareness • Education • IDNDR promotional activities	• PR work of UN and other humanitarian institutions • Publications	• Information from media (Monitoring) • Information to media (on field level)

As revised by the First Meeting of the WGET, 16 November 1994

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Previous

Emergency Telecommunications, an Annotated Bibliography Updated Edition, January 1996

* * *

This bibliography has been compiled and is continuously being updated by the United Nations Department of Humanitarian Affairs (DHA), Relief Co-ordination Branch, Geneva, within its Project DPR 121 (29-4), Emergency Telecommunications with and in the Field. All books and documents are on file at DHA Geneva.

* * *

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Summary of the discussions of a high-level round table of the Annenberg Washington Programme on Communications Policy Studies, Northwestern University. Relevant operational telecommunications, as they serve as channels for inputs to the international media (6 p.).

Cauderay, Gérald C. Means of identification for protected medical transports (in: International Review of the Red Cross, No.300 (Geneva, 1994) [Bib.15]

Comments on the respective regulations in the geneva Conventions and related Protocols, concludes that "identification is no longer a technical problem but an issue that largely depends on the will of the parties concerned to recognize the right of protected transports . . ." (13 p.).

Chamoux, J.-P. & Stern, P.-A. (Ed.) Restructurer les Télécommunications (Paris, 1993) [Bib. Z-2]
Part three, "Politiques et Reglementations" analyses regulatory structures and procedures in North America and France and part five, "Etudes de Cas Africains" analyses telecommunications development in 14 African countries (399 p.).

Comfort, Louise K. Integrating Information Technology into International Disaster Policy and Practice, Working Paper 92-3 of the Institute of Governmental Studies, University Pittsburgh (Pittsburgh, 1991) [Bib.46]
A preliminary model of organizational problem solving, focusing on the global problems of seismic risks, based on information technology to reduce uncertainty by increasing the timeliness and accuracy of information to disaster managers (21 p. + bibliography).

Comfort, Louise K. Designing an Interactive, Intelligent, Spatial Information System for international Disaster Assistance, Working Paper 91-1 of the Institute of Governmental Studies, University of Pittsburgh (Pittsburgh, 1991) [Bib.47]
Analysing the problem of efficiency in international disaster assistance and proposing a design for an Interactive, Intelligent, Spacial Information System (IISIS) on an interactive field status board data base, graphic mapping capability and a capacity for logical inference from field information to relevant knowledge bases (18 p.).

Commission of the European Communities Green Paper on the Development of the Common Market For Telecommunications Services and Equipment (COM(87)290 final) (Brussels, 1987) [Bib. Z-3]
Analysis of the effects of the European common market on telecommunications matters, covering commercial/industrial as well as institutional and regulatory issues (210 p.).

Commission of the European Communities Green Paper on the Liberalization of Telecommunications Infrastructure and Cable Television Networks, Part II, Document COM(94) 682 final (Brussels, 1994) [Bib. Z-41]
Analyzes the current situation in the European communications market, defines societal and cultural issues and the need for liberalization, lists issues for further consultation regarding the development of the regulatory framework to meet the challenges of convergence. Does not specifically consider Emergency Telecommunications, but gives an overview of the existing regulatory framework in the EU countries and the envisaged developments (141 p.).

Communications International (Ed.) U.N. targets Telecoms for Emergencies (in: Telecom 95 daily, 10 October 1995, p. 4) [Bib. 94]
Statement on the presence of Emergency Telecommunications at Telecom 95, Geneva, September 1995 (1 p.).

COMSAT Mobile Communications Inmarsat-A User's Guide (Clarksburg, MD, 1995) [Bib. Z-46]
The introduction gives an overview over the functioning of the Inmarsat Standard A system and the following chapters describe typical services provided, specifically by COMSAT but applicable to most service providers' systems (92 p.).

Corbett, John R.G. Where there is no Telephone, published by the Baptist Missionary Society (Didcot, England 1988) [Bib. Z-45]
A handbook on short wave radio communication for mission and aid agencies in developing countries. Intended for technical as well as non technical personnel, it covers all elements, from the planning of a network to detailed technical instructions for the installation of equipment (118 p.).

Corbett, J.R.C. Where there is no Telephone (Didcot, Oxon, England, 1999) [Bib. Z-50]
A handbook on shortwave radio communication for missions and aid agencies in developing countries describes how to plan, select, install and operate a radio telephone network and deals with

the special considerations for reliability. Addressed to both technical and non- technical personnel, the book also includes an excellent overview of possible solutions and available tools on the standards of 1988 (118 p.). COSPAS-SARSAT Secretariat COSPAS-SARSAT Glossary (Volume 1, English / French / Russian), C/S G.004 (London, 1991) [Bib.44] English / French / Russian Glossary of terms used in the context of satellite telecommunications, in particular referring to the COSPAS-SARSAT system but generally applicable (60 p.).

DeSoto, Clinton B. 200 Metres and down, the Story of Amateur Radio (West Hartford CT, 1936, 1981) [Bib. Z-17-HZ]
Description of the regulatory process regarding Amateur Radio 1900 - 1935, Chapter 20 giving a summary of Emergencies in which this service was relevant (184 p.).

DHA, United Nations Department of Humanitarian Affairs Facilitation Measures in Customs conventions which can expedite delivery of international emergency humanitarian assistance (Information Paper, Geneva, 1994) [Bib. Z-14]
Quotes relevant parts of Kyoto Convention, A.T.A. Convention, Istanbul Convention and contains list of signatories of above and sample forms (13 p.).

DHA, United Nations Department of Humanitarian Affairs Humanitarian Early Warning System -HEWS- (New York, 1994) [Bib.64]
Project description and Implementation plan for the Humanitarian Early Warning System (14 p.).

DHA, United Nations Department of Humanitarian Affairs Information Management System Development at DHA, Status report June 1994 and Action Plan July - December 1994 (Geneva, 1994) [Bib.65]
Overview of the existing and planned information managements systems at DHA and related requirements, some parts are out-dated due to new developments (10 p.).

DHA, United Nations Department of Humanitarian Affairs Internationally agreed glossary of basic terms related to Disaster Management (Geneva, 1992) [Bib Z-32]
English - French - Spanish Glossary, including agreed definition of terms such as Disaster, Mitigation, Remote Sensing, Relief, Mobile Satellite Communication System (Satcom) etc. (83 p.).

DHA, United Nations Department of Humanitarian Affairs (Ed.) Rwanda, Lessons learned, a Report on the Coordination of Humanitarian Activities, prepared by Antonio Donini and Norah Niland (New York, 1994) [Bib. 98]
An critical analysis of the response of the UN to the humanitarian crisis in Rwanda, including an evaluation of the information flow and suggestions for better co-ordination as well as practical organization of communications flow. (48 p.).

DHA, United Nations Department of Humanitarian Affairs INSARAG, Advisory Group for International Cooperation in Disaster Relief Report of the Second Meeting (1993) of the Regional Group for Asia and the Pacific (Geneva, 1994) [Bib. Z-11]
The meeting stated under agenda issue 1, that "Communication and air transport were identified as critical areas immediately after the disaster" and requested under agenda issue 4 the improvement of Networking, including inter alia the use of the world wide amateur radio network(35 p.).

DHA, United Nations Department of Humanitarian Affairs Guidelines on the Use of Military and Civil Defense Assets in Disaster Relief (Geneva, 1994) [Bib. Z-13]
Under "Tasks of States", paragraph 58 (g), the receiving state should take all appropriate steps to facilitate foreign MCDA in their execution of IDRA, inter alia by "authorization of transport and communication usage", footnote 5 refers to WTDC Resolution No.7 (67 p.).

DHA, United Nations Department of Humanitarian Affairs Workshop on use of Military and Civil Defense Assets in Disaster Relief, Brussels 1992, DHA/93/57 (Geneva, 1993) [Bib. Z-12]
Contains list of UN GA resolutions referring to Humanitarian Emergency Assistance, Terms and Definitions; Working group 5 stated the need for the "granting of communications rights" by the

affected country (80 p.).

DHA, United Nations Department of Humanitarian Affairs Cyclone "Hollanda" and Cyclone "Ivy" (Mauritius and Rodrigues Island) (Geneva, 1994) [Bib. Z-4]
Includes a case study on the effect of cyclone "Hollanda" on the telecommunications infrastructure of Mauritius and recommendations for improvements regarding preparedness (11 p. + annexes).

DHA, United Nations Department of Humanitarian Affairs The Great Hanshin-Awaji (Kobe) Earthquake in Japan, On-Site Relief and International Response (Geneva, 1995) [Bib. Z-51]
Analysis of the response to the earthquake and of problems encountered, including those regarding the telecommunications infrastructure (111 p.).

DHA, United Nations Department of Humanitarian Affairs The Vital Role of Emergency Telecommunications in Disaster Relief and Mitigation, DHA "Issues in Focus" series, No. 2 (Geneva, 1995) [Bib.91]
Re-print of DHA News No. 11-12, 1994 , including the emergency telecommunications related articles and the texts of the Tampere Declaration and ITU Resolutions WTDC-94 No.7 and PP- 94 No.36 (16 p.).

Dubi, Jean Guide pour la MaÎtrise des Catastrophes, pour l'Organisation Internationale de Protection Civile et avec l'appui du Corps Suisse d'aide en cas de catastrophe, (extracts only) (Berne, 1995) [Bib. 95]
Analysis of disaster response, in particular within the European framework, with an annex of relevant legal instruments (incl. Council of Europe resolution 7148/91 of 8 July 1991) (79 p.+annex.)

Dumont, Patrick Low Earth Orbit Mobile Communication Satellite Systems: A Two- Year History since WARC-92, Paper presented at the 45th Congress of the International Astronautical Federation, IAF-94-M-4-293, (Jerusalem, 1994) [Bib.30]
Describes the regulatory environment, commercial implications and technical developments regarding the use of LEO satellites for communication systems, covering "big LEO" voice links as well as "little LEO" data links (11 p.).

Edin, Pär Global Emergency Observation and Warning, in: Mobile Communications International, October 1994 (London, 1994) [Bib.48]
Description of the "GEOWARN" System, integrating in a first step existing resources and creating 5 regional centres, adding own means of observation (airplanes and satellites) in second and third phases, including satellite telecommunications links (Inmarsat B and M) (3 p.).

Edwards, Lynn Ellen The Utilization of Amateur Radio in Disaster Communications (University of Colorado, Boulder CO, 1994) [Bib. Z-7]
Describes the use of Amateur Radio in Disaster Communications in the USA, includes case studies and bibliography

EIS International The Emergency Information System EIS/Win, description of a software for crisis management (Rockville MD, 1995) [Bib. 71]
Description of a commercially available software for emergency management, including support to communications and telecommunications requirements for the use of the system in the field (16 p.).

ELO, Sara Good News on Disasters, Paper presented to the DAGS'95 Conference of Electronic Publishing and the Information Superhighway (Cambridge MA, 1995) [Bib. 69]
Paper proposing improvements of information on disasters, based on augmenting of the text by means such as comparisons giving the reader a better understanding of the dimensions of an event. Relevant to emergency telecommunications with regard to the content of information to be made available and resulting technological requirements (8 p.).

Elotu, Joseph Telecommunications for Emergency Relief Operations (ITU, Geneva 1985) [Bib.10]

Describes an overall system for local and national/regional emergency telecommunications, using all available technologies, including traditional means of communication, as well as the mandate and the role of the ITU (28 p.).

Elotu, Joseph Disaster Communications, Statement to the iic Annual Conference 1994 (Tampere, Finland, 1994) [Bib.22]
Describes the progress made in Telecommunications for Emergency Telecommunications and the position of the ITU (3 p.).

Elotu, Joseph Telecommunications and the Environment (Colchester, UK, 1976) [Bib.11]
Analyzes the impact of modern technologies on business and politics, in education, entertainment, interpersonal relations and the organization of society, on the example of Uganda (15 p.).
Elotu, Joseph Statement by the Representative of the ITU to the UNDRO International Conference on Disaster Communications (Geneva, 1990) [Bib.14]
Announces support of ITU for IDNDR, including the "Establishment of protocols governing the use of emergency equipment (Customs formalities and technology transfer restrictions)" (3 p.).

Elotu, Joseph Development of Telecommunication Networks and International Cooperation for Disaster Reduction (in:Information Flows in Disaster Management of Metropolitan Areas, Report and Summary of Conference Proceedings, (UNCRD, Nagoya, Japan, 1991) [Bib. Z-19, article also Bib.6]
Contribution to the Fifth International Research and Training Seminar on Regional Development Planning for Disaster Prevention , Theme 3, Technical Innovations in Information for Disaster Reduction in Metropolitan Areas, Issue 1, Development of Telecommunications Networks and International Cooperation for Disaster Reduction. Refers to Tampere Declaration and need for a Convention on Disaster Communications (7 p.).

Essaafi, M'Hamed Statement to the IIC Conference on Disaster Communications (Tampere, Finland 1991) [Bib.17]
Stating "the need to obtain international agreements facilitating entry, exit and operation of communications equipment by relief teams in disaster-stricken countries" (6 p.).)

Federal Emergency Management Agency The Federal Response Plan (Washington DC,1992) [Bib. Z-6]
Describes in detail the mandate and functioning of FEMA (32 p. + ca.18 annexes)

Gillies, Douglas "Can we Talk?" Reviewing Communications Systems after Sudden Cataclysmic Disasters (in: Hazard Technology, Vol.XIV, Number 4, Fall 1994) (Santa Barbara CA, 1994) [Bib.60]
Very critical analysis of recent experience in disaster communications in the USA, many findings are applicable to international relief operations as well (3 p.).

Goodman, Mark and Williamson, Ray A. International Cooperation in Earth Observations, Paper presented at the 45th Congress of the International Astronautical Federation (Jerusalem, 1994) [Bib.35]
Reports on the results of a broad assessment of U.S. and international Earth observation systems, requested by committees of the U.S. Congress, summarizing opportunities and drawbacks of expanded international cooperation in Earth observations (11 p.).

Great Northern Telegraph Company (Ed.) From dots and dashes to tele and datacommunications (Copenhagen, 1995) [Bib. Z-54]
The history of telecommunications, in particular from Scandinavia to the Far East, including examples of the application of telecommunications to emergency situations (78 p.).

Hansen, Peter Introductory Statement at the Economic and Social Council (ECOSOC) 1994 Session (New York, 1994) [Bib.66]
Description of the co-ordination role and mechanisms of DHA, including operational field co-ordination, and the resulting needs for appropriate communications at all levels (8 p.).

Harbi. Mohamed The ITU Contribution, International Colloquium on Post-Conflict Strategies (Schladming, Austria, 1995) [Bib. 84]

Presentation to the international symposium, describing the role of ITU in the assessment and evaluation of damage caused to telecommunications structures and the assistance provided (5 p.).

Hoso-Bunka Foundation (Ed.) Analysis of the Great Hanshin Earthquake: Lifeline Information and the Role of Broadcasting, Symposium Report, Tokyo, Japan, 1995 [Bib. Z-48]
Critical contributions of seminar participants on the response of the media to the earthquake and on their actual and future roles in disaster situations (35 p.).

Hudson, Heather E. Communication Satellites, Their Development and Impact (London and New York, 1990) [Bib. Z-25-HZ]
Describes the technical history and legal / political implications of communications satellites of all types, their use for media and mobile communications, and contains a substantial bibliography (338 p.).

Hunkeler, K. and Lanius, P. Kurzwellenkommunikation in Weitverkehrsnetzen (in: Report, Technische Zeitschrift der Alcatel STR AG, September 1995) [Bib. Z-47]
Technical overview regarding long-distance shortwave telecommunications links and their interfacing with other private and telecommunications networks including their role in WAN and their possible links to LAN systems (10 p.).

Hurder, Luck (Ed.) The ARRL Emergency Co-ordinator's Manual, Amateur Radio Emergency Service, published by the American Amateur Radio Relay League, ARRL, 2nd Ed. (Newington CT, 1993) [Bib Z-33]
Instruction manual, covering the outline of the amateur radio emergency services in the USA, organizational and operational issues, liaison with relief agencies and including an annex of Statements of Understanding between the ARRL and other organizations (164 p.).

Hurder, Luck (Ed.) Public Service Communications Manual, published by the American Radio Relay League, ARRL, (Newington CT, 1990) [Bib.Z-34]
Description of the amateur radio emergency service in the USA and procedures of the National Traffic System for the handling of messages via amateur radio, including an annex of regulations, lists and sample forms (58 p.).

IDNDR, International Decade for Natural Disaster Reduction Report of the Scientific and Technical Committee on its fifth Session (Geneva, 1993) [Bib. 70]
Report including description of the scope of activities of the committee, relevant for the use of the IDNDR STC as a channel for information about emergency telecommunications as an element of mitigation, includes list of STC members and of participants of the fifth session (31 p.).

IDNDR International Decade for the Reduction of Natural Disasters (Ed.) Stop Disasters Newsletter, Number 22, with articles on the role of telecommunications in disaster preparedness (Geneva, 1995) [Bib. 83]
Articles by: Claude de Ville de Goyet, Gunilla Gustafs, Art Botterell, Eduard M. Gross and Patrick T. Stingley, Peter S. Anderson, Ricardo Pérez Martinez and others (31 p.).

IFRC, International Federation of Red Cross and Red Crescent Societies Emergency Response Unit "Telecommunications" (Geneva, 1995) [Bib. 86]
A manuscript describing the tasks and structure of the Emergency Response Unit "Telecommunications"; attached are an outline of the related training programme, a list of standard frequencies for emergency response units and a list of standard equipment (33 p.).

Ingram, Dave Oscar, the Ham Radio Satellites (Blue Ridge Summit PA, 1979) [Bib. Z-31-HZ]
Technical and operational history of the early amateur radio satellites, example for non geo-stationary communications satellites allowing access from low-power ground stations (140 p.).

Inmarsat (Ed.) Emergency Experts Press for Progress (in: Transat, July 1994, Number 27) (London, 1994) [Bib.18]

Describes the IDNDR Conference and WTDC Resolution No.7 with their importance for mobile satellite communications in emergency situations (2 p.).

Inmarsat (Ed.) Digital satphones set for Chinese flood protection (in: Transat, Number 29, November 1994) [Bib.56]
Article on the lifting of some of the restrictions on the use of Inmarsat-M equipment in China in addition to Inmarsat-A stations already in use at flood prevention offices (1 p.).

Inmarsat Inmarsat Commissioning and Licensing Contact Points, (Manuscript / Table) (London, 1994) [Bib.28]
List of authorities involved in the commissioning and licensing of mobile satellite terminals world wide in alphabetical order, including comments on procedures and national regulatory issues where available (48 p.).

Inmarsat Report of the Meeting of Experts on Transborder Use of Land Mobile Earth Stations (London, 1991) [Bib.41]
Review of the regulatory situation, in particular WARC Resolution 209 (MOB-87) and the Tampere Declaration. By the Conclusions and Recommendations annexed to the report, Inmarsat is requested to undertake inter alia the preparation of "multinational agreements such as a Memorandum of Understanding" on transborder use of Inmarsat Land Mobile Earth Stations. Includes statement of the USA delegation, requesting inclusion of "all other transportable earth stations" (11 p.).

Inmarsat Licensing Inmarsat Terminals (Manuscript / Presentation) (London, probably 1994) [Bib.27]
Presentation of Licensing procedures, covering technical, administrative and commercial issues and the transborder use of land mobile satellite terminals (11 p.). Inmarsat Transborder Use of Inmarsat-C & Inmarsat M, List of Countries having implemented respective resolutions (London, 1994) [Bib.40] Table of countries having implemented CEPT 21-07 (generic to land mobile satellite services), CEPT 31-02 (Standard C), CEPT 21-11(Standard M) (2 p.).

Inmarsat Draft International Agreement on the Transborder Use of Inmarsat Land Mobile Earth Stations (Manuscript) (London, 1994) [Bib.29]
Draft text for an agreement between governments, to allow the transborder use of Inmarsat Land Mobile Earth Stations (LMESs) in other countries than that of registration; parties are to deposit ratification documents with the United Nations Secretary-General and to inform the ITU (5 p.).

Inmarsat Free Airtime Policy boosts Relief Efforts (in:Transat, May 1995) [Bib. 88]
Describes the implementation of the Inmarsat Council decision to grant free air time during acute disasters (1 p.).

Inmarsat (Ed.) Possible Use of Inmarsat Communications Facilities for Emergency Relief Operations on Land (manuscript) (London, 1981) [Bib.24]
Describes the technical and regulatory aspects up to 1981, annexes include WARC-79 resolutions

Inmarsat The Inmarsat International Conference and Exhibition on Mobile Satellite Communications (London, 1993) [Bib. Z-5]
Includes contributions regarding the trans border use of land mobile satellite terminals in general and for emergency relief operations (ca.600 p.).

Inmarsat Survey of National Regulations Relating to the Use of Land Mobile Earth Stations (manuscript) (London, 1994) [Bib.26]
Lists the results of surveys conducted by Inmarsat on a country-by-country basis, Status September 1994 (17 p.).

Inmarsat (Ed.) Relief Efforts Focused with Satcoms, in: "Transat" No. 23, November 1993 [Bib. 50]
Describing the use of Inmarsat terminals by DHA and in particular by UNDAC Stand-by teams (1 p.).

Inmarsat Rescue Roles in Hurricane's Trail (in: Transat, November 1995) [Bib. 87]
Brief description of the role of Land Mobile Satellite Telecommunications in relief operations following hurricane "Luis" in the Caribbean, September 1995 (1 p.).

Inmarsat The Satcoms Portfolio (in: Transat, January 1995) [Bib. 73]
Description of the Inmarsat A, B, A-HSD, M and C systems and selection table for the appropriate system for different requirements regarding modes and volume of traffic (3 p.). Inmarsat Inmarsat Commissioning and Licensing Contact Points (including latest available regulatory information) (London, 1994) [Bib.55] Addresses of national licensing authorities and summaries of relevant national regulations concerning land mobile earth stations (48 p.)

International Telecommunication Union (Ed,) Du sémaphore au satellite (Geneva, 1965) [Bib. Z-30]
Review of the history of telecommunications, including references to early regulatory issues and the priority of distress and safety communications (343 p.).

International Institute of Communications (Ed.) Disaster Communications (Special Feature edition of Inter Media, Volume 23, No.6, p. 35-43), London 1995 [Bib. 93]
Articles on disaster communications, including a partial transscript of the special session of the Annual IIC Conference (Osaka, 1995) (9 p.).

International Astronautical Federation Book of Abstracts of all papers presented at the 45th International Astronautical Congress (Jerusalem, 1994) [Bib. Z-22]
Collection of all abstracts submitted under the main theme: Space and Cooperation for Tomorrow's World (192 p.).

International Telecommunication Union The International Telecommunication Union, an Overview (fourth Edition, Geneva 1994) [Bib. Z-16]
Introduces the mandate and structure of the ITU, refers to interconnection with public telecommunications networks for life line connections in emergency situations (29 p.).

International Telecommunication Union (ITU) World Telecommunication Development Report (Geneva, 1994) [Bib. Z-18]
Overview of telecommunications development world-wide, covering technological development as well as regulatory issues (108 p.).

International Atomic Energy Agency Guidance on International Exchange of Information and Data Following a Major Nuclear Accident or Radiological Emergency (Vienna, 1992) [DHA Env.U]
Paragraph 321, p.19, recommends the use of UNDRO (now DHA) facilities for the acceleration of the dissemination of information in all phases from early warning and notification to the mobilization and co-ordination of assistance.

James, Rosemond W. Study on the Potential Applications of State-of-the-Art Communications Technology to Disaster Preparedness and Response, prepared for the Caribbean Disaster Emergency Response Agency CDERA (St. Michael, Barbados, 1994) [Bib.59]
The report analyzes a) the extent to which modern technology is presently in use, b) factors preventing more widespread use, c) potential benefits from increased use and d) proposes a strategy to increase the use of modern technology (45 p. + 22 Annexes).
Katayama, Tsuneo, Aftermath of the Loma Prieta Earthquake (International Center for Disaster-Mitigation Engineering, Tokyo, 1992) [DHA 4436] Case study on the functioning and role of radio broadcast stations in the San Francisco area during and immediately after the Loma Prieta Earthquake of 1989 (96 p.).

Kent, Randolph C. The International Management of Disasters: Clarity, Communications and Cooperation, Paper presented at the Annenberg Workshop on Communications on Global Disasters and International Information Flows (Washington DC, 1986) [DHA 3258]
Describes the need for effective communications networks, analyzes the way in which the nature of

disasters affects the information loading cycle ((36 p.).

Kessler, Claudia et al. Earth Watch, Disaster Management using Satellites, Paper presented at the 45th Congress of the International Astronautical Federation (Jerusalem, 1994) [Bib.39]
A proposal to use existing ground and space infrastructure for pilot projects to demonstrate the use of satellite systems for disaster management, related to the "Geowarn" system and emphasizing easy and fast access by final users (5 p.).

Kiplagat B.A. and Werner, M.C.M. (Ed.) Telecommunications and Development in Africa (Amsterdam, 1994) [Bib.Z-38]
Published by the Telecommunications Foundation of Africa (Belgium), the book describes Economics, Finance and Regulation, User Needs, Regional Cooperation, New Technology and contains case studies on Cameroon, Mozambique, Gambia, Botswana, Kenya, Guinea/Sierra Leone/Liberia (302 p.).

Kraml, Jiri Disaster Communications, initial study prepared for UNDRO (Geneva, 1989) [Bib. 82]
An analysis of available technology and recommendations for the acquisition of equipment for UNDRO (17 p.).

Larock, V. and Ginati, A. IRIS: Going Commercial With High-Tech European LEO Microsatellites, Paper presented at the 45th Congress of the International Astronautical Federation (Jerusalem, 1994) [Bib.38]
Describes a low-cost commercial messaging service project based on LEO micro satellites, using spread-spectrum store and forward technology (12 p.).

Le Monde Economique (Ed.) World Communications, a Wholly New World (Paris, 1995) [Bib. Z-53]
Texts by authors from telecommunication industry and policy, outlining the state-of-the-art technologies available for all kinds of applications (365 p.).

Lucot, Jean Paul Management des Telecommunications dans les Organismes de Secours Internationaux (Geneva, 1990) [Bib. Z-15]
Comprehensive description of telecommunications systems, mainly of ICRC and IFRC, with references to regulatory issues (336 p. + annexes).

Maki, Haruhisa Telecommunications Service Means a Lot in the Very Moment of Emergencies Caused by Natural Disasters (in: NTT Review, Vol.5, No.4, Tokyo, 1993) [Bib. Z-10]
Sub-title: Telecommunications Disaster Prevention Measures and Service Restoration Examples. States need for decentralization of permanent networks and presents Japanese case studies.

Mann, Brad Straight Talk: the value of effective disaster communications. In: Emergency Preparedness Digest, April-June Ed. (Ottawa, Canada, 1994) [Bib.4]
Brief case-studies and application of experiences to the situation in Canada, considering media as well as operational telecoms (5 p.).

Milot, Michel Industry Canada (Telecommunication) major plans and programs to deal with "Telecommunications" civil emergency plans (Ottawa, Canada, 1995) [Bib. 81]
A description of the structures of emergency telecommunications for disaster preparedness and response in Canada, including the terms of reference of the national emergency telecommunications committee (8 p.).

Minear, L., Weiss, T., Campbell, K. Humanitarianism and War, Learning the Lessons from Recent Armed Conflicts, Brown University, Occasional Paper # 8 (Providence RI, 1991) [Bib. Z-9]
Analyzes the specific problems confronting humanitarian assistance in situations of armed conflict, in particular the need for co-ordination and for legal instruments to allow the provision of assistance (72 p.).

Minear, Larry and Weiss, Thomas G., Humanitarian Action in Times of War, A Handbook for

Practitioners (Boulder CO & London, 1993) [Bib. Z-23]
Analysis of the political and legal framework of international humanitarian assistance, in particular in cases of armed conflict. Not directly mentioning telecommunications, but reference for political framework under which operations, including telecommunications, function (105 p.).

Monterey Peninsula Amateur Radio Emergency Service (ARES) Emergency Plan (Monterey CA, 1994) [Bib. 68]
Example of an emergency plan institutionalizing the use of the amateur radio service, including amateur radio stations with emergency capabilities as well as the provision of amateur radio operators to emergency services (3 p.).

Mooser, Pablo A. Manual de Tecnicas de Operacion de la Red Nacional de Emergencia, published by Liga Mexicana de Radio Experimentadores A.C., LMRE (Mexico D.F. 1981) [Bib. Z-36]
Manual, covering regulatory, operational and technical aspects of emergency telecommunications via amateur radio in Mexico, including description of major risks and listing details of national agencies in charge of disaster response (117 p.).

MPT Japan MPT Issues White Paper on Information and Communications Industry for FY 1994 (in: New Breeze, Summer 1995) (Tokyo, 1995) [Bib. 97]
Under section II, paragraph A, the paper refers to the lessons learned from the Great Hanshin and Awaji Earthquake regarding the need for improved survival and recovery capabilities of telecommunications networks (7 p.).

Naeslund, Brigitta Policy and Regulatory Issues Affecting the International Satellite Organisations: The Eutelsat Perspective, Paper presented at the 45th Congress of the International Astronautical Federation, IAF-94-M.1.274 (Jerusalem, 1994) [Bib.33]
Describes the specific legal and regulatory issues encountered by three International Satellite Organisations (ISOs), namely Inmarsat, EUTELSAT and INTELSAT, considering their different structures and the commercial as well as the political environment in which they operate (3 p.).

National Emergency Telecommunications Committee (NETC) (Canada) (Ed.) Industry Canada (Telecommunication) major plans and programs to deal with "Telecommunications" civil emergency plans (Ottawa, 1995) [Bib. 67]
Example of national regulations regarding emergency telecommunications, including an explanatory letter and the terms of reference of the National Emergency Telecommunications Committee (9 p.).

National Research Council (Ed.) Practical Experiences from the Loma Prieta Earthquake, Report from a Symposium sponsored by the Geotechnical Board and the Board on Natural Disasters of the National Research Council (Washington DC, 1994) [Bib. Z-28]
The effect of the earthquake on the existing public communications systems is covered in Chapter 5 (Lifeline Perspectives), with details on the very limited damage to the telecommunications infrastructure but very severe effects of systems overload (237 p. + annexes).

Office of International Services of the American Red Cross Disaster Response Guidelines (Washington DC, 1989) [DHA 3911]
Guidelines for US Embassies, including advise on the use of substitute communications such as Amateur Radio during emergencies (15 p.).

Office of the United Nations Disaster Relief Co-ordinator (UNDRO) The International Decade for Natural Disaster Reduction (IDNDR), Presentation at the UNDRO International Conference on Disaster Communications (Geneva, 1990) [Bib.12]
Introduces IDNDR and describes the needs and requirements for communications links in disaster preparedness and prevention (7 p.).

Office of Foreign Disaster Assistance (OFDA / USAID) (Ed.) Field Operations Guide, (Washington DC, 1994) [Bib. Z-43]

Contains instructions regarding assessment of damage to telecommunications infrastructure and for field telecommunications of OFDA / DART teams during emergencies (pocket size, approx. 300 p.)

Office of the United Nations Disaster Relief Co-ordinator (UNDRO) Fourth Meeting of Officials in Charge of National Emergency Relief Services (NERS IV) (Geneva, 1992) [DHA 4241]
The meeting considered Disaster Communications, referring to the Tampere Declaration, and confirmed the need for further developments in this field (64 p.).

Organization of American States (OAS) Draft Inter-American Convention to Facilitate Disaster Assistance (no place and date) [Bib.45]
Draft for a regional, multi-national agreement on international disaster assistance, does not specifically mention communications, but covers equipment and personnel as well as services in general. Origin of document is probably OFDA or FEMA (7 p.).

Palm, Rick The FCC Rule Book, Guide to the FCC Regulations, published by the American Radio Relay League, ARRL (Newington CT, 1994) [Bib. Z-35]
Commentary of the regulations established by the Federal Communications Commission, FCC, of the USA, in particular part 97, covering the amateur radio services and included as an annex (267 p.).

Pan American Health Organization (PAHO) (Ed.) Emergency Health Management after Natural Disasters (Washington DC, 1981) [Bib. Z-20]
Chapter 8 describes the role and the means of the telephone, telex, amateur radio and CB services and the option of "donated transceivers" for the health sector after a natural disaster (67 p.).

Pan American Health Organization (PAHO) SUMA, Supply Management Project in the Aftermath of Disasters (Washington DC, 1994) [Bib. Z-40]
Example of a regional (pan-American) disaster response concept, including radio communications procedures (56 p.).

PHARE Programme of the Commission of the European Communities Federal Ministry of Posts and Telecommunications, Czech and Slovak Federal Republic, Final Report (Brussels, 1992) [Bib. Z-26]
Example for the national legislative and regulatory framework in eastern European countries (31 p. + annex).

Planning and Coordination Division, Disaster Prevention Bureau, National Land Agency, Prime Minister's Office, Disaster Countermeasures in Japan (Tokyo, 1991) [DHA 4908]
Describes the disaster countermeasures established by the Government of Japan, 2 attached brochures refer to the communications system and overseas activities respectively (24 p. + attachments).

QST, Official Journal of the American Amateur Radio Relay League, ARRL Selection of articles concerning amateur radio emergency operations (Newington CT, 1973 - 1993) [Bib. 49]
A selection of articles, covering the Managua earthquake 1972, the Guatemala earthquake 1976, the Friuli earthquake 1976, the hurricanes David and Frederick 1979, the Nevado del Ruiz volcanic eruption 1985, the Mexico earthquake 1985, the Equador earthquake 1987, the Armenia earthquake 1988, hurricane Hugo 1989, hurricane Andrew 1991, hurricane Iniki 1992, earthquake Los Angeles 1994 (43 p.).

Rom, Svend Telecommunications Action Plan, for UNHCR (Geneva, 1987) [Bib. Z-42]
Analysis of the development of telecommunications volume of UNHCR and of systems used by UNHCR and other institutions, suggestions for the introduction of advanced technology and lower cost systems. Partially implemented in the late 1980s.

Rosen, David Documentation on the Role of the Amateur Radio Readiness Group of the UN Amateur Radio Club (New York) 4U1UN (New York, 1994) [Bib. Z-29]
Documentation, including copies of messages, press clippings and letters of appreciation regarding

the work of the group (101 p.).

Rotberg, Robert I. and Weiss, Thomas G. The Media, Humanitarian Crises and Policy-Making (World Peace Federation, WPF Report number 7, Cambridge MA, 1995) [Bib. Z-39]
Report of an international meeting organized by the WPF and the Watson Institute, Brown University. Includes Recommendations to policy makers, humanitarian actors and members of the media, stating the necessity for appropriate communications technology of humanitarian actors (22 p.).

Ruesch, K. and Cauderay, G.C. Telecommunication Network of the International Committee of the Red Cross (in: Telecommunications Journal, Vol.56 - I/1989) [Bib.8]
Describes the Red Cross radio networks and refers to Resolution No.10 of WARC-79 and support from the ITU (5 p.).

Sagar, David William Use of Inmarsat for Disaster Relief Communications (Statement to the Conference on Disaster Communications) (Tampere, Finland, 1991) [Bib.21]
Describes the need to overcome regulatory barriers and the existing regional agreements on the trans-border use of Inmarsat equipment (7 p.).

Sagar, David National and International Licensing Regimes for Mobile Earth Stations (Inmarsat manuscript) (London, 1993) [Bib.25]
Describes the present situation, existing restrictions and Inmarsat's approach towards a liberalization and a reduction of regulatory barriers in particular regarding trans-border use of Land Mobile Earth Stations (9 p.).

Salmon, Anthony Draft description of the UN Telecommunications Network for Humanitarian and Disaster Relief, paper prepared for the second WGET plenary meeting (Geneva, 1995) [Bib. 77]
An analysis of the implications of Resolution 50 of the ITU Plenipotentiary Conference (Nice, 1989) on the use of UN networks, in particular VSAT links, by other than UN entities and persons (3 p.).

Sands, Philippe The Tampere Declaration on Disaster Communications (Fifth Draft) (Tampere, Finland, 1991) [Bib.19]
A further draft for a Declaration, served as a basis for the document actually adopted by the conference (7 p.).

Sands, Philippe The Tampere Declaration on Disaster Communications / Draft Convention on Post-Disaster Telecommunications Assistance (Working Draft for the International Institute of Communications) (London, 1991) [Bib.13]
Annotated manuscript for an elaborate Declaration and Convention, both documents were far too specific to obtain approval from the Conference, but their content was reflected in the Tampere Declaration of 1992 (19 p.).

Scott, John C. Telecommunications Technologies for Disaster Management, Three Thoughts from a User Perspective (paper presented to the Tampere Conference on Disaster Communications) (Arlington VA, 1991) [Bib.57]
Describing the available technology and its potential uses in disaster management (4 p.).

Shaio, A. The Role of Amateur Radio in Natural Disasters (in: Telecommunications Journal, Vol.56 - I/1989) [Bib.9)
General description of the voluntary work of amateur radio in disaster communications, refers to ITU Resolution 640 (4 p.).

Staffa, Eugene The Use of Inmarsat in Disaster Mitigation and Emergency Assistance Operations (in: STOP Disasters, Number 18, March-April 1994) (Geneva, 1994) [Bib.20]
Describes the role of Inmarsat and refers to trans-border use of mobile terminals and the various agreements existing so far (3 p.).

Swan, Peter A. Global Customer Satisfaction, the Iridium Way, Paper presented at the 45th Congress of the International Astronautical Federation, IAF-94-M.3.285 (Jerusalem, 1994) [Bib.62]
Brief description of the Iridium global cellular satellite system (5 p.).

Tarjanne, Pekka, Keynote Address to the IIC Conference on Disaster Communications (Tampere, Finland, 1992) [Bib.1]
Stresses the importance of reliable telecommunications in case of disasters, describes the mandate of ITU, suggests work towards a "framework Convention", an "agreement" to "facilitate the prompt establishment of telecommunications links for disaster management" (7 p.).

Taylor, 'Shola Satellite Communications in Developing Countries - In Search of a Viable Regulatory Framework, Paper presented at the 45th Congress of the International Astronautical Federation, IAF-94-M.1.790 (Jerusalem, 1994) [Bib.31]
Describes the regulatory restrictions for the use of satellite communications in many developing countries and gives an overview of the ITU SPACECOM project, which aims at assisting developing countries in creating a suitable regulatory framework (6 p.).

UN (DPCSD) United Nations, Division for Sustainable Development Draft Task Manager's Report for Chapter 40, "Information for Decision-Making and Earthwatch", Department for Policy Coordination and Sustainable Development (New York, 1994) [Bib. 51]
Manuscript, stressing in various paragraphs the need for improved availability of information for decision making and making recommendation for the strengthening of information systems to governments, the United Nations System and the international community (60 p.).

UN (Committee on the Peaceful Uses of Outer Space) Coordination of Outer Space Activities within the United Nations System Programmes of Work for 1995 and 1996 and future Years, Report of the Secretary-General to the General Assembly (New York, 1994) [Bib. 75]
Summary of all major activities within the UN system, including those related to telecommunications via satellite and related regulatory and training issues (49 p.).

UNCRD United Nations Centre for Regional Development The Socioeconomic Impact of Disasters, Report and Summary of Proceedings of the fourth International Research and Training Seminar on Regional Development Planning for Disaster Prevention (Nagoya, Japan, 1990) [Bib. Z-24]
Case studies on the impact of disasters on infrastructure and resulting impact on businesses in the affected area (181 p.).

UNDP / IAPSO, United Nations Development Programme, Inter-Agency Procurement Services Office Items for Emergency Relief, Telecommunications Equipment, Copenhagen, 1994 [Bib. 54]
The introduction in Part 1, Specifications, gives an outline of the requirements for a typical emergency telecommunications network, specifically regarding the needs at field level (20 p.).

UNEP, United Nations Environment Programme Mercure, A Satellite Communication System defined by the European Industry for UNEP, System Description (Rev.4, Nairobi, 1993) [Bib.42]
The Mercure System would provide UNEP with a modern global communication capability for the transfer of environmental data. It would link with the GIS/GRID systems and is part of a Global Environmental Monitoring System (GEMS) project (18 p.).

UNHCR, United Nations High Commissioner for Refugees A UNHCR Handbook for the Military on Humanitarian Operations, Training with UNHCR (Geneva, 1994) [Bib. 74]
Defines the guiding principles and the legal framework of humanitarian action and the role of military peace support activities and logistics support in the field (59 p.).

UNHCR, United Nations High Commissioner for Refugees Handbook for Emergencies, Parts I and II (Geneva, 1982) [Bib. Z-8]
Contains guidelines for communications systems during refugee emergencies, specifically in part 2, annex 1 (312 p.).

UNHCR, United Nations High Commissioner for Refugees UNHCR Procedure for Radio Communication (Geneva, 1995) [Bib. Z-49]

A brief instruction for users of mobile VHF and HF voice radio communications in the field, including checklists, emergency instructions, list of procedure words and the ICAO spelling alphabet (18 p.).

UNICEF, United Nations Children's Fund Assisting in Emergencies, A resource handbook for UNICEF field staff (New York, 1986) [Bib. Z-37]

Instructions regarding communications include (p.425) the note, that "[an in-country radio network] [...] must be authorized by the appropriate government agency [and] it might be operated under direct government control or by an approved agency" (526 p.).

Various authors and sources The Kobe earthquake, "quake mission for KDD satcoms" in Transat and other information relating to emergency telecommunications following the Kobe earthquake January 1995 (Various, 1995) [Bib. 72]

Various reports, articles and communications regarding the emergency telecommunications following the Kobe earthquake, including the provision of free satellite time for Inmarsat terminals used in disaster relief operations (initially 3 p.).

VITA (Volunteers in Technical Assistance) (Ed.) VITASAT / VITACOM / Packet Radio, A Communications Technology for the Third World (Arlington VA, 1994) [Bib.36]

Three brochures on the concept and the technical specifications on a low-cost data communications system based on LEO satellites, using laptop computer, TNC and low power VHF/UHF links for data communications (20 p.).

VITA, Volunteers in Technical Assistance Capability Statement (Arlington VA, 1995) [Bib. 85]

Contains a description of the VITA projects on emergency telecommunications, in particular the VITASAT concept (12 p.).

Wallace, William A. On Managing Disasters: The use of Decision-Aid Technologies (New York, 1989) [DHA 3796]

Analysing technological developments in view of their impact on Disaster Relief, specifically on emergency telecommunications and the role of the media."...the influence of governmental policies and international cooperation will play a more important role than technological advances."(46 p.).

Walter, Louis S. The Uses of Satellite Technology in Disaster Management (in: Disasters, The Journal of Disaster Studies and Management, Vol. 14, No.1, 1990) [Bib.16]

Describes the technical development and present possibilities regarding the use of satellites technology in mitigation and relief, states the need for an international agreement and an organizational structure. UNDRO should, within IDNDR carry out a programme towards this (16 p.).

Webster, David (Ed.) Communication when it's needed most (The Annenberg Washington Program in Communications Policy Studies of Northwestern University, Washington DC, 1989) [DHA 3887]

Collection of articles by different authors, covering i.a. telecommunications in disaster relief and mitigation, role of the media, draft for a Convention on Disaster Communications (129 p.).

World Health Organization Disaster Preparedness and Relief, Development of the Programme, including an Information and Communication System (Geneva, 1986) [DHA 2968]

States the need for communications in a disaster situation, requests independent communications systems for operational purposes within medical assistance as well as to counteract rumours caused by lack of information (28 p. + annexes).

Wood, Mark Disaster Communications, published by the Disaster Relief Communications Foundation (UK), (Topsham, England, 1995) [Bib. Z-44]

A training manual, covering technical, operational and regulatory aspects of all types of emergency

telecommunications, VHF/UHF, HF and satellite links and of all modes, voice, SITOR, DATA etc. An annex contains technical and regulatory documents (148 p. + annex).

World Meteorological Organization (WMO) Co-operation with the United Nations and other Organizations, Report to the plenary of the twelfth Congress of WMO (Geneva, 1995) [Bib. 80, extract only]

Outlines in paragraph 9.1.18 the possibilities for support of humanitarian and relief efforts by the WHO (3 p.).

Zimmermann, Hans The Use of Satellite Telecommunications in Disaster Relief Operations, Paper presented at the 45th Congress of the International Astronautical Federation, IAF-94-M.3.287 (Jerusalem, 1994) [Bib.3]

Summarizes the history of the use of satellite telecommunications for disaster relief, with bibliography (10 p.).

Zimmermann, Hans Communications in a Disaster: The Osaka Panel Debates (in: IIC Members Newsletter, International Institute of Communications, Vol.6, No. 3, p. 10), London, 1995 [Bib. 92]

Report on the panel discussion on disaster communications at the Annual Conference of the IIC (Osake, September 1995) (1 p.).

Zimmermann, Hans Emergency Telecommunications at and with Disaster Sites, Presentation in the UNDAC Training Course (Geneva, 1993) [Bib. 52]

Presentation of the concept of emergency telecommunications and practical introduction for users of field telecommunications equipment provided by DHA for UNDAC teams and for an OSOCC (20 p.).

Zimmermann, Hans Emergency Telecommunications for Humanitarian Aid, (in: Speaker's Papers, Strategies Summit, Telecom 95, ITU) (Geneva, 1995) [Bib. Z-52 and Bib.89]

Describing the development and the present status of the DHA Project on Emergency Telecommunications and the Working Group on Emergency Telecommunications (WGET) and outlining the way towards the International Convention on Emergency Telecommunications (4 p.).

Zimmermann, Hans The role of Vehicles in UNHCR Operations (UNHCR TSS Mission Report 87/10, Geneva, 1987) [Bib. Z-27-1 and Z-27-2]

Annex 11 contains Draft Manual and Guidelines for Radio Networks, specifically mobile networks for use during refugee emergencies (84 p. + Annexes).

Zimmermann, Hans Comments on the UNHCR Telecommunications Action Plan of 1987 (Berne, 1988) [Bib. 79] A critical comment on the plan developed by Sven Rom for UNHCR (7 p.+ annex).

Zimmermann, Hans Statement to the World Telecommunications Conference, Buenos Aires 1994 (in ITU, WTDC-94 Final Report, Vol.II, Document No.72, Geneva, 1994) [Bib. Z-21, text also Bib.2]

Describes mandate of DHA and supports proposals for a resolution on Disaster Communications (4 p.).

Zimmermann, Hans Statement to the Plenipotentiary Conference of the ITU, Kyoto 1994 (in ITU, PP-94 Final Acts) (Geneva, 1994) [Bib.37]

Statement on the present regulatory situation regarding Emergency Telecommunications (2 p.).

Zimmermann, Hans Emergency Telecommunications for Humanitarian Aid, Keynote Speech, Strategies Summit, Telecom 95, (Geneva, 1995) [Bib.90]

Text of Keynote Speech, summary of paper (Bib.89) on the same subject and occasion (2 p.).

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THE TAMPERE DECLARATION

ON DISASTER COMMUNICATIONS

Conference on Disaster Communications

Tampere, Finland, 20 - 22 May 1991

Purpose

1.The group of experts in communications and disaster management participating in the Conference on Disaster Communications held at Tampere, Finland, from 20 - 22 May 1991, declare that there is an urgent need to improve international co-operation in communications and enhance national communications capabilities in order to reduce loss of life, damage to property and livelihoods, and damage to the environment caused by disasters. For the purpose of this Declaration disasters are viewed as extreme occurrences which outstrip the ability of an affected society to cope with them. Behind these events often lie chronic problems stemming from the interaction of natural, environmental and man-made factors. In this regard the Tampere Conference welcomes the proposal for a Pilot UN Centre for Urgent Environmental Programme, Nairobi.

2.The Tampere Conference reiterates the primary responsibility of national authorities for disaster management and communications. The supportive role of international organizations in disaster management is highlighted. The Conference also recognizes the important role played by indigenous and international non-governmental organizations in disaster mitigation and relief.

3.The Tampere Conference recognizes that disasters have killed millions of people over the past twenty years alone and caused massive financial and other damage to people, property and the environment. Such disasters will continue to occur frequently around the globe, with particularly devastating consequences in the developing countries. Further efforts are required to prevent such disasters and alleviate their consequences.

4. The Tampere Conference stresses that improved flows of international information through terrestrial and satellite telecommunication technologies can assist in the prediction, monitoring and early warning necessary to prevent some of the consequences and reduce the impact of such disasters once they have occurred. There is an urgent need to improve the nature, scope and quality of information being transmitted internationally, including its validity, significance, accuracy and timeliness.

5.The critical role of the mass media in providing public information services to communities at risk is recognized, as is their broader role in education and opinion-forming, particularly with regard to slow-onset disaster.

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6.Terrestrial and satellite communications, including established international satellite networks, and remote-sensing technologies, have played, and will continue to play, major roles in reducing the devastating effects of disasters by dramatically improving hazard identification and risk assessment, disaster preparedness, monitoring, early warning and onset and post-disaster relief operations. These facilities are in practice not universally accessible, particularly in developing countries where such disasters most frequently occur.

7.Communications links are almost always disabled and disrupted during the first hours of a major disaster. When disaster strikes, there is an urgency to establish effective and comprehensive communication links at the disaster site, between the site and the national systems for dealing with disaster response and with the concerned international community.

8.The Tampere Conference endorses the Preamble and Major Needs identified and the Recommendations adopted at the UNDRO International Conference on Disaster Communications on 21 March 1990 and held in the context of the International Decade for Natural Disaster Reduction (IDNDR).

9.The Tampere Conference calls for the development of a Convention on Disaster Communications as elaborated further below and to be negotiated not later than 1993. This Convention should be viewed in the context of a future comprehensive accord on disaster management.

10.The Tampere Conference recognizes the urgent communications needs generated by emergency disaster relief and the longer-term needs of disaster mitigation.

Communications in Disaster Relief

11.Present limitations to disaster communications include:

a) Organizational barriers which impede the flow of information among the various elements of the international disaster response network.

b) Uncertainty over the availability and location of communications equipment which could be made accessible for disaster use.

c) Regulatory barriers which slow down the importation and operation of communications equipment.

d) High costs which inhibit the effective us of communications equipment during disasters.

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12.In order to overcome these barriers, a Convention on Disaster Communications should, at a minimum:

a) Establish an effective framework for co-operation between and among State parties, inter-governmental and regional organisations,

b) Further improve the coordination of international disaster management.

c) Ensure the utilization to the maximum extent of existing global, regional and national terrestrial and satellite communications networks encourage the immediate availability at national, regional and international centres of communications equipment and encourage the development of the amateur radio services and their application to disaster communications.

d) Encourage national authorities to establish an inventory and/or data base of their own communications equipment and resources relevant to disaster relief, national regulations to ensure access to them, and a na appropriate national preparedness plans for their effective use.

e) Encourage UNDRO, within the framework of the International Decade for Natural Disaster Reduction, to maintain an international inventory of communications equipment and resources and to invite national governments, inter-governmental organizations, non-governmental organizations and other relevant entities to make their own communications equipment and resources information available

f) Encourage improved and enhanced national international training programmes to develop the necessary expertise in the rapidly-evolving field of disaster communications, and the further consideration of the communications issue in disaster management training programmes.

g) Facilitate the rapid dissemination and effective use of communications equipment and resources by limiting, reducing and, where possible, removing regulatory barriers,

including:

%Customs clearance procedures and duties

%Restrictions on possession and use

%In appropriate restrictions on the dissemination of existing and new technical information

%The need for type-approval procedures and operating licences, including simplification

%National rules concerning the temporary assignment of appropriate radio frequencies.

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- 4 -

h) Establish appropriate further rules relating to matters such as:

%Entry, exit and transit for personnel, equipment and property

%Direction and control of assistance

%Confidentiality of information

%Privileges, immunities and facilities

%Claims and compensation.

i) Establish 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.

Communication in Disaster Mitigation

13.Effective early warning systems and comprehensive data bases are limited by the unequal access to communications technology, soft ware and expertise.

14.The proposed Convention should, at a minimum, establish mechanisms for international cooperation in the use of terrestrial and satellite telecommunications technologies in the prediction, monitoring and early warning of disasters, especially the early dissemination of information to those in the at-risk communities.

The Way Forward

15.The Tampere Conference recommends that no later than 1993 an inter-governmental conference be convened under the auspices of UNDRO to prepare for the negotiation of an International Convention of Disaster Communications to establish appropriate mechanisms to improve international cooperation. This conference should be complementary to envisaged inter-governmental action to facilitate the use of communications equipment for disaster relief and to the global meeting of IDNDR National Committees proposed for 1993.

16.To carry through the above suggestions - the enhancement and improvement of disaster communications - will require a realistic financial commitment form the international community,

including governments, international organizations, donor organizations, non-governmental organizations and the private sector.

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- 5 -

17.The proposed Convention should take account of existing provisions and proposals, including Resolution No. 209 (Mob-7) of the World Administrative Radio Conference for the Mobile Services, Geneva 1987, on the Study and Implementation of a Global Land and Maritime Distress and Safety System.

18.The development of the proposed Convention on Disaster Communications should be co-ordinated by UNDRO , in cooperation with the ITU and other relevant organizations, including international terrestrial and satellite telecommunications operating organizations.

19.Recognizing that the development of such a Convention will take time, the Tamper Conference calls upon all States to consider urgent measures to give effect to the provisions of their Declaration on an interim unilateral or bilateral basis for general humanitarian reasons.

20.The Tampere Conference recommends that, consistent with the goals and objectives of the International Decade for Natural Disaster Reduction, the UN Disaster Relief Coordinator should take the appropriate steps to implement the intent of this Declaration with the support of and in consultation with, other concerned bodies of the UN system, international terrestrial and satellite telecommunications operating organizations and non-governmental organizations.

21.The Tampere Conference recommends that this Declaration be circulated to governments, inter-governmental organizations and non-governmental organizations, and in appropriate interactional fora, such as the November 1991 International Red Cross Conference and the June 1992 UN Conference on Environment and Development, and be considered in the relevant activities of concerned organizations and institutions at the international, regional and national levels.

22.The Tampere Conference expresses its gratitude to the government of Finland and the City of Tampere for hosting the Conference; to the International Institute of Communications for convening it; to the Aamulehti Group Ltd and the Annenberg Washington Program in Communications Policy Studies of Northwestern University for their support; to UNDRO, the ITU, UNHCR, WMO, WHO and the League of Red Cross and Red Crescent Societies for their support; to the Post and Telecommunications of Finland, the Centre for Public Service Communications, and the Centre for International Environmental Law for their assistance; and to all those present for their participation.

* * *

Note: **The paragraphs to which Resolution COM4/14 of the ITU Plenipotentiary Conference (Kyoto 1994) refers are printed in bold typeface.**

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VITA Communications Service

Many International PVOs and NGOs, including Inter-Action members, have expressed interest in networking electronically with Southern partners. While Internet access has been considered a privileged for those in the developing world, an increasing number of Southern countries are gaining affordable Internet access, especially to E-mail.

The enthusiasm for using E-mail to communicate with Southern partners is high. From the point of view of Internet users in the United States, communicating via E-mail is inexpensive, efficient and fast. However, before sending E-mail or transferring files to computers in other countries, it is important to keep in mind that many Internet users abroad pay much more for a telephone link to the nearest Internet, Bitnet or Fidonet host and must often pay extra for information sent to them via computer.

Additional problems, such as a limited amount of phone lines available for individual users and poor telephone service, make international computer networking a challenge. The good news is that alternative ways of sending E-mail are being used in remote areas through technology developed and used by Volunteers in Technical Assistance (VITA).

> **Volunteers in Technical Assistance is the first private voluntary organization to apply advanced micro- electronics and space technology to the dissemination of technical information for development and humanitarian purposes.**

VITACOMM

VITA has developed a global communications system VITACOMM, for developing countries. VITACOMM consists of VITASAT, a *Low Earth Orbiting* (LEO) satellite system; VITAPAC, a series of independent short-wave packet radio systems; and VITANET, an electronic-message delivery system that uses existing telephone networks. VITACOMM can assist the relief and development community with such things as disaster mitigation, prevention, and response; health education and information; vehicle tracking; data gathering and dissemination; and administrative and logistic support.

VITA's goal is to bring under-served areas of the world into the mainstream. As VITA's President Henry Norman has said:

> *Development cannot take place without communication, and in the information age, communication can't take place without information.*

Many developing countries are anxious to expand their communication systems along with their markets. VITA seeks to facilitate southern countries' participation in the information revolution in order to improve their citizens' quality of life.

VITA maintains its commitment to working with existing telecommunications systems in other parts of the world. VITA works with local phone companies to promote a decentralized communications system. It encourages entrepreneurs in larger population centers to own and operate terrestrial telecommunications networks. By supplementing Fidonet, a PC- based, low-cost Internet-like system used in may parts of Africa and Eastern Europe, VITA's Internet Host creates a broader spectrum of networking options for those in the developing world.

VITASAT

VITASAT is designed specifically for developing countries. The satellite collects data over South America and Africa, and as it flies over gateways located in the far North and South, it transmits the contents to ground stations. This system permits data to be delivered anywhere in the world in 90 minutes. Additionally, the ground stations do not require field personnel to be present when the data transfer occurs.

VITASAT is low-earth orbiting (LEO) satellite system that permits data to be sent worldwide. VITASAT acts like an orbiting postman. When a ground station is within the footprint of the satellite, the station can retrieve or transmit messages. The VITASAT satellite is a store-and-forward system, first storing the messages form the ground station and then forwarding them to their respective destinations. Once the LEO receives a message, it can forward it to the proper destination in under 12 hours.

VITA has been working with two LEO satellites since 1984. In mid-1995, a new satellite will be launched, called VITASAT-A (a.k.a. GEMSTAR-1), which will provide commercial-grad communications worldwide. Along with this new satellite which will operate at higher speeds and with larger memory capability than earlier systems, a new series of ground stations is being developed. These will be highly portable in nature, requiring only that a laptop computer be attached. The new groundstation, with software and portable antennas, is projected to cost about $3,500 in the initial production run. Options will include solar panel/battery power supplies and tracking antenna systems. On- line charges will cost roughly $50 per month for up to 100k of information transferred, with special rates for greater amounts. Service will be initiated before the end of 1995.

VITAPAC

VITAPAC is a series of independent digital packet radio systems, which allows computers to communicate with each other via radio. Each station in a VITAPAC network consists of a computer or terminal, a two-day radio, a modem-like device called a Terminal Node Controller (TNC), a printer, and an antenna. Messages entered into the computer or terminal are sent to the TNC, which adds address and error-checking codes. The TNC then breaks the message into small pieces (packets) that are transmitted by the radio to the receiving station. In turn, the receiving station. In turn, the receiving station's TNC decodes the message and sends it to their computer or terminal. Despite its level of technical sophistication, one TNC unit costs only about $300, and an entire VITAPAC station, including the computer, costs between $4,000 and $10,000 plus installation and training. A key advantage of VITAPAC is that system computers may be used for other purposes when the network is not active.

VITANET

VITA's electronic communication system, VITANET, was established in 1987 to provide a stand-alone Bulletin Board System (BBS) as part of VITA's Disaster Information Center. VITANET allows NGOs, PVOs, government agencies and others to obtain current information concerning natural disasters, listings of companies and individuals offering commodities or technical assistance, and communicate with staff and volunteers. Through VITANET, users can form links using other networks (e.g. Bitnet, Internet, and Fidonet). People in disparate sections of the globe, employing different networks, can share information via VITANET as if connected to a single system.

VITANET uses standard telephone lines and modems to connect personal computers with specialized software. The modems and the software contain error-correcting protocols that ensure that messages and files are transferred correctly.

VITANET included two software components; a BBS and a mailer. The bulletin board contains private message areas (where messages can be addressed to specific individuals) and public conference areas (where messages can be read by all users with access). File areas contain reports that can be uploaded, downloaded, or read on-line.

The mailer allows registered BBS users to transfer messages and files between VITANET and similarly configured systems. It can also be setup to request files from other computers. The mailer is coordinated with the BBS so that incoming and outgoing mail form any network is routed to the correct recipient.

BT

Gateway

Customer Information

THE PORTISHEAD RADIO GATEWAY SERVICES

1. BACKGROUND TO PORTISHEAD RADIO

Portishead Radio is the operational control centre for British Telecom International's terrestrial aeronautical and maritime communications division. We have served the long distance communications requirements of both aero and shipping industries for over 60 years.

During the last ten years technological advances have completely revolutionized short wave radio communications. During this time we have maintained and consolidated our long standing reputation as world leader, incorporating careful planning for modernization.

2. BACKGROUND TO "GATEWAY"

Despite the vast advances of recent years, there remain areas of certain countries where lines of communication are sometimes non-existent.

Exploration, mining, construction, welfare, aid and many other projects operating within these remote areas find themselves entirely isolated, cut off not only from essential domestic communications but also from important international contacts.

3. DEVELOPMENT OF "GATEWAY"

Portishead radio's widespread experience in the most exacting disciplines of radio communications, together with the latest computerized control techniques, powerful transmitters and directional aerials, have enabled us to provide reliable telex and voice communications into some extremely remote locations.

Demand has proved sufficient for us to dedicate a special group of carefully selected radio channels for the exclusive use of "GATEWAY" participants, ensuring maximum circuit availability.

Gateway
Portishead Radio Station British Telecom Highbridge Somerset TA9 3JY
Telephone (+44) 278 772253. Facsimile (+44) 278 772222. Telex (+51) 46506 BTGKA G

British Telecommunications plc Registered Office 81 Newgate Street LONDON EC1A 7AJ Registered in England no. 1800000

PHME 8793/10/91

DOJ EX. 1025

4. "GATEWAY" IN ACTION

In many situations a single base radio station will fulfil all requirements. This can be installed with either local and/or international communications (via Portishead radio) in mind. Each installation will normally be individually arranged to suit precise requirements.

Within the remote area, a local communication 'net' can be established, perhaps working around and into one main base station. Operations within this net will be entirely free of charge and may encompass voice, telex, data and packet radio channels.

Where external communications are required, base station contact with Portishead radio via "GATEWAY" radio channels enables direct access into worldwide auto-telex circuits: Similarly, voice circuits via Portishead radio "GATEWAY" will be extended to international telephone networks.

As previously mentioned, operations within a closed network will incur no charges whatsoever. There is no subscription charge for participation in the Portishead radio "GATEWAY" service: Only Portishead radio's circuit occupancy time is chargeable.

5. SITE EQUIPMENT

Compatible H/F radio communications equipment may already be available to certain sites. It is however unlikely that local suppliers will be able to offer software suitable for remote installations to take advantage of all "GATEWAY" facilities.

In view of our wide experience and interest in the success of "GATEWAY" it is strongly recommended that all equipment enquiries, indeed all "GATEWAY" enquiries be passed to Portishead Radio. We will gladly arrange contacts as necessary between interested parties and suppliers of proven equipment, who can arrange for specifications and costs to be quoted.

"GATEWAY" has been tried and tested with both fixed and portable equipment sited in the most remote locations. Modern equipment running off external or inbuilt power sources enables automatic compilation of complicated texts, auto selection of an optimum communication channel and transmission via an internationally recognized and respected carrier - British Telecom Worldwide Networks.

5. SITE EQUIPMENT CONTINUED

Carefully designed software, together with reliable yet simple to operate equipment, enables totally untrained and inexperienced on-site staff to maintain local and international communications.

Responsibility for conforming with local administration and licensing regulations lies with the operating company. We may be able to offer guidance on this matter but find that local regulations do vary greatly, local knowledge and contacts providing an invaluable element.

6. YOUR NEXT MOVE

For details of how to set up a "GATEWAY" Link into Portishead Radio whether for Radio Telex and/or Radio Telephone please contact our customer support office as soon as possible, our address, telex and telephone numbers are quoted at the bottom of this page.

Customer Services Office
BT HF Radio Station
Portishead Radio
HIGHBRIDGE
Somerset TA9 3JY
ENGLAND

Tel: 0278 772253

Fax: 0278 772222

Tlx: 46506 BTGKA G

BT

Gateway

Customer Information

TRAINING ONLY

RADIOTELEPHONE FREQUENCIES (AERONAUTICAL AND GATEWAY)

4807
5610 - FOR AIRCRAFT OPERATIONAL CALLS ONLY
6634 - FOR AIRCRAFT OPERATIONAL CALLS ONLY
8170
8960 - FOR AIRCRAFT OPERATIONAL CALLS ONLY
10291
11306 - FOR AIRCRAFT OPERATIONAL CALLS ONLY
12133
14890
15964
16273
17335
18210
19510
20065
23142

ALL FREQUENCIES MONITORED 24 HOURS A DAY OR AS RADIO CONDITIONS PERMIT.

TRAINING ONLY

Gateway
Portishead Radio Station British Telecom Highbridge Somerset TA9 3JY
Telephone (+44) 278 772253. Facsimile (+44) 278 772222. Telex (+51) 46506 BTGKA G

British Telecommunications plc Registered Office 81 Newgate Street LONDON EC1A 7AJ Registered in England no. 1800000

PHME 8793/10/9.

DOJ EX. 1025

TRAINING ONLY

PORTISHEAD RADIO AERONAUTICAL SERVICE

BT

GKX

September – December 1995
No. 47

Aeronautical & Maritime Radio,
Portishead Radio Station,
Highbridge, Somerset TA9 3JY, England.

☎ National 01278-772200
☎ International +441278-772200
Telex: 46506 BTGKA G

WATCHKEEPING FREQUENCIES IN kHz

*5610	*6634	8170	*8960	VHF
10291	*11306	14890	20065	131.625 mHz

*Restricted to Aircraft Operational Control in the North Atlantic region. Communications not related to safety and regularity of flight are prohibited.
When calling please allow up to 15 seconds for one of our transmitters to select your frequency.

H.F. PROPAGATION FORECASTS

Graphs show the predicted optimum frequencies for direct HF communication with Portishead Radio. The absence of a curve indicates a frequency cannot be predicted. All times are shown in GMT. Watchkeeping on higher frequencies is subject to propagational conditions.

CHARGES AND SERVICES
Please refer to the separate buff-coloured sheet for details.

DOJ EX. 1025

TRAINING ONLY

PORTISHEAD RADIO AERONAUTICAL SERVICE

BT **1995** **GKX**

Aeronautical & Maritime Radio, Portishead Radio Station
Highbridge, Somerset TA9 3JY, England.

☎ National 01278-772200 ☎ International +441278-772200 Telex: 46506 BTGKA G

Portishead Radio is operated by BT from its control centre in Somerset, England using the very latest techniques in long range communications and is backed by 75 years' experience in both maritime and aeronautical radio services.
Service is provided H24 to all aircraft fitted with high frequency simplex or duplex equipment.

Examples of charges in sterling for phone patches to subscribers in:

United Kingdom	£3.10p per min
Europe	£3.82p per min
USA/Canada	£4.08p per min
Rest of World (max.)	£5.26p per min

Detailed charges to individual countries are available on request.

Messages
Charged at a rate of 15 words = 1 minute
Phone patch rates, delivered by phone, fax, Telex or SITA.

Value Added Tax @ 17.5% to UK billing addresses.

H24 FREQUENCIES IN Khz

4807	*5610	*6634	8170
*8960	10291	*11306	12133
14890	15964	16273	17335
18210	19510	20065	23142

VHF 131.625 Mhz

When calling please allow up to 15 seconds for one of our transmitters to select your frequency.

* Restricted to Aircraft Operational Control in the North Atlantic region. Communications not related to safety and regularity of flight are prohibited.

- Operational phone patches are available and we accept messages for onward transmission via SITA (BRSOOXH).
- Personal calls from flight crew and passengers are welcomed with accounting to the caller's UK home number or posted to any address in the UK or overseas.
- Account numbers are available on request and offer a convenient and secure method of identification for billing.
- Selcall facilities and radio checks are available free of charge.
- Propagation forecasts regularly distributed to all clients free of charge – please advise us of your requirements.
- Automatic radio telex from suitably equipped aircraft.
- Medical advice is offered free of charge.
- No contract fees involved – payment only for services rendered.
- One minute charging applies on the simplex frequencies.
- Bureau services – messages delivered by fax, tele· ·hone or po·

END

DOJ EX. 1025

TRAINING ONLY

Table 1: Long range radiotelephone: frequencies and callsigns

Callsign	International channel	Portishead carrier kHz	Portishead Assigned kHz	Ship station carrier kHz	Ship station Assigned kHz	
GKT20	410	4384	4385.4	4092	4093.4	Main channel
GKT22	402	4360	4361.4	4068	4069.4	HF Autolink
GKT26	406	4372	4373.4	4080	4081.4	
GKV26	426	4432	4433.4	4140	4141.4	
GKU46	816	8764	8765.4	8240	8241.4	Main channel
GKT42	802	8722	8723.4	8198	8199.4	
GKU49	819	8773	8774.4	8249	8250.4	HF Autolink
GKV42	822	8782	8783.4	8258	8259.4	
GKV46	826	8794	8795.4	8270	8271.4	
GKW41	831	8809	8810.4	8285	8286.4	HF Autolink
GKV54	1224	13146	13147.4	12299	12300.4	Main channel
GKT51	1201	13077	13078.4	12230	12231.4	
GKT52	1202	13080	13081.4	12233	12234.4	
GKT56	1206	13092	13093.4	12245	12246.4	HF Autolink
GKV58	1228	13158	13159.4	12311	12312.4	
GKV50	1230	13164	13165.4	12317	12318.4	
GKW52	1232	13170	13171.4	12323	12324.4	
GKT62	1602	17245	17246.4	16363	16364.4	Main channel
GKT66	1606	17257	17258.4	16375	16376.4	
GKU61	1611	17272	17273.4	16390	16391.4	
GKU65	1615	17284	17285.4	16402	16403.4	HF Autolink
GKU68	1618	17293	17294.4	16411	16412.4	
GKV63	1623	17308	17309.4	16426	16427.4	
GKW62	1632	17335	17336.4	16453	16454.4	
GKW67	1637	17350	17351.4	16468	16469.4	
GKW60	1640	17359	17360.4	16477	16478.4	
GKT18	1801	19755	19756.4	18780	18781.4	Main channel
GKU18	1803	19761	19762.4	18786	18787.4	
GKT76	2206	22711	22712.4	22015	22016.4	Main channel
GKU72	2212	22729	22730.4	22033	22034.4	
GKU74	2214	22735	22736.4	22039	22040.4	
GKU70	2220	22753	22754.4	22057	22058.4	
GKV77	2227	22774	22775.4	22078	22079.4	
GKV79	2229	22780	22781.4	22084	22085.4	
GKX70	2240	22813	22814.4	22117	22118.4	
GKU25	2502	26148	26149.4	25073	25074.4	Main channel

Note:
Portishead Radio monitors the main channels where ships make their initial call. These channels are also used for the broadcast of traffic lists, distress, urgency and safety signals. HF Autolink indicates that those channels are reserved for Autolink only.

267/298

DOJ EX. 1025

Table 2: Long range radiotelex: frequencies and callsigns

Callsign	International channel	Portishead assigned kHz	Ship assigned kHz	
GKE2	2	4211	4173	Main channel
GKL2	7	4213.5	4175.5	
GKP2	8	4214	4176	
GKY2	13	4216	4178.5	
GKQ2	14	4216.5	4179	
GKE3	2	6315	6263.5	Main channel
GKP3	12	6319.5	6268.5	
GKL3	16	6321.5	6270.5	
GKQ3	22	6324	6273	
GKE4	2	8417	8377	Main channel
GKP4	13	8422.5	8382.5	
GKY4	19	8425.5	8385.5	
GKI4	20	8426	8386	
GKQ4	27	8429.5	8389.5	
GKE5	2	12580	12477.5	Main channel
GKL5	25	12591.5	12489	
GKP5	28	12593	12490.5	
GKY5	48	12603	12500.5	
GKQ5	56	12607	12504.5	
GKE6	2	16807.5	16684	Main channel
GKL6	29	16820.5	16697.5	
GKP6	36	16824	16701	
GKY6	42	16827	16704	
GKQ6	68	16840	16717	
GKE7	2	22377	22285	Main channel
GKP7	34	22393	22301	
GKL7	42	22397	22305	
GKY7	58	22405	22313	
GKQ7	66	22409	22317	

Note:
Main channels are used for broadcasting traffic lists, weather warning, general information, distress, urgency, and safety signals. Channels open for traffic emit a channel free signal.

TRAINING ONLY

Intentionally Blank.



Inmarsat

99 City Road,
London EC1Y 1AX
United Kingdom

THE USE OF INMARSAT IN DISASTER RELIEF AND EMERGENCY ASSISTANCE OPERATIONS

Eugene I. Staffa
Manager, Disaster, Emergency
and Aid Communications
Inmarsat

"...disasters have killed millions of people over the past twenty years alone and caused massive financial and other damage to people, property and the environment. Such disasters will continue to occur frequently around the globe..."

The International Conference on Disaster and Emergency Communications, Tampere, 1991

INTRODUCTION

This paper describes the use of Inmarsat equipment and services in combatting natural disasters. The International Decade for the Natural Disasters Reduction (IDNDR) has given a strong impetus to disaster mitigation efforts, which include provision of communications not affected by disasters. Although telecommunications cannot prevent a natural disaster from happening, they can help reduce its impact. Inmarsat can be used in all critical phases of dealing with natural disasters: monitoring and prediction, warnings and early intervention measures, emergency operations as well as providing an on-going support during rehabilitation and reconstruction.

Inmarsat has been providing emergency communications since the start of its operations in 1982. Now it is taken almost for granted that the first relief workers to arrive in the area affected by the disaster will carry with them a portable Inmarsat satellite communications terminal.

National and international relief organisations, for example the UNDHA, UNICEF, organizations of the Red Cross/Red Crescent movement, medical and humanitarian relief agencies (e.g. OXFAM, CARE, Medecins sans Frontieres) as well as international aid and development agencies (e.g. UNDP, USAID), own or lease Inmarsat transportable satellite terminals. With the cost of owning and operating an Inmarsat terminal continually decreasing, more and more organizations join the ranks of Inmarsat users, including national emergency, and civil defence agencies.

DOJ EX. 1025

THE USE OF MOBILE SATELLITES IN NATURAL DISASTERS

1. Contingency planning

Each year, the world suffers hundreds of natural disasters. Floods, hurricanes, volcanic eruptions, earthquakes and tidal waves of various intensity and physical and social consequences are reported almost daily. Although certain regions, such as the Caribbean, the southeastern US, the Bay of Bengal and Southeast Asia suffer most frequently and grievously, natural disasters can and do occur virtually anywhere. There is evidence that the frequency and severity of disasters themselves may be increasing.

Suitable contingency plans can help minimize the impact of natural disasters. This would typically include the pre-positioning of emergency supplies and communications equipment at strategic locations in areas known to be at risk. As the process of needs identification, funding and deployment can take many months, such activity should be started as soon as possible. In addition to contingency plans, it is essential that designated local personnel undertake training and regular reviews to ensure they are ready to operate mobile satcoms when a real disaster occurs.

Another requirement for good contingency planning is to simplify and streamline reporting from the field, so that all relevant information can be transmitted speedily and accurately. One way is to use standardized forms, which can also be computerized. Using this approach, even long lists and reports can be compiled quickly and transmitted via mobile satcoms to disaster relief coordinators and other relevant agencies. For more complex needs, software programs already exist (e.g. the SUMA program developed for PAHO/WHO) that can be used in the management of supplies and personnel from the home base.

The agencies typically involved in planning disaster communications are national civil defense and preparedness organizations. The Red Cross and other medically-oriented organizations also participate. A lot of activity is done on a regional basis. For example, virtually every country in Central and South America and the Caribbean has expressed interest in mobile satcoms; the main stumbling block is the lack of funds, while the level of technical ability and technology understanding is steadily increasing. The Caribbean Disaster Emergency Agency (CDERA), coordinating disaster emergency activities of 14 islands, has established a pilot project using Inmarsat terminals as part of their plan to increase emergency preparedness.

2. Monitoring, Prediction and Early Warning

Inmarsat terminals coupled with appropriate sensors can provide SCADA - Supervisory Control and Data Acquisition. Such equipment can play a vital role in providing or improving the monitoring and early warning functions, even from the most remote areas. At a UN/UNDRO/ESA "Workshop on the Application of Space Techniques" (Mexico City, September 1993), a number of early warning applications using satellites were presented. The monitoring of geothermal and volcanic variables, tectonic plate movement and pressure ridges helps identify potential volcanic or earthquake activity ahead of its happening. Mexico has already implemented a line of seismic sensors along the most vulnerable part of its west coast presently using RF links; these will be replaced by satellite links on account of their lesser susceptibility to effects of natural disasters.

3. Emergency Operations

When a disaster strikes, telecommunications are often disrupted or rendered ineffective. It could be many hours before the world is even aware of a disaster. Frequently, there is a considerable delay between the onset of the disaster and the arrival of first relief workers and this in turn leads to valuable time being lost.

Good contingency planning, preparation and access to mobile satcoms enable local authorities and relief teams communicate with each other as well as with the outside world immediately. This enables the experts to make an initial assessment of the damage, report the facts - including transmissions of photos and video - and request appropriate aid in the critical first 48-72 hours when the scope for saving lives is at its greatest.

In the absence of locally available Inmarsat equipment, the stricken area must rely on the outside sources of telecommunications equipment. Some of the most notable uses of Inmarsat by international rescue teams were in the aftermath of the earthquakes in Turkey (1992), Iran (1990) and Armenia (1988), as well as during the volcanic eruption in the Philippines in 1991. Inmarsat was extensively used during the hurricane Hugo devastation of the island of Montserrat (1989) when all the island's communications links, including fixed satellite and cable, were destroyed. Inmarsat communications have been used in the aftermath of the typhoons and floods in Bangladesh and China (1991), the cyclone Val in Western Samoa and the Indian earthquake and floods in September 1993.

Immediately following a disaster, it is easy for field workers in their vehicles or trucks carrying relief supplies to become immobilized due to local conditions. Therefore, regular communications and position reporting is highly desirable. Using Inmarsat mobile satcoms and GPS, the operations control is able to monitor the progress and location of all equipped vehicles, as well as send messages to them, regardless of the state of the local infrastructure, weather conditions and other impediments.

4. Rehabilitation and Reconstruction

Although telecommunications are high on the list of priorities during the rehabilitation and reconstruction phase following a disaster, it could be weeks or even months before the communications infrastructure is back to normal. During this period, mobile and transportable satcoms support the rehabilitation work, enabling local government and business to function. They can also be made available for social calling and contacts with the press and the media.

Coordination of relief and rehabilitation work is often difficult and expensive, particularly in massive or complex emergencies. However, developments in cellular radio technology and falling costs of cell site management equipment have resulted in some novel applications. A multi-channel satphone can be connected to a cellular radio microcell, or with a Private Branch Exchange (PBX) to multiple fixed users. A number of manufacturers now offer the requisite equipment to connect to Inmarsat satcoms. The average cost per minute in a multichannel operation can be below $3.00/minute.

5. Long-term Relief and Development

Many natural disaster events have a longer term impact on the region where they occur. They can cause hardship and dislocation of people, whose needs continue after the disaster has vanished from the news headlines. The management of supplies from the outside world and possible subsequent re-development work is frequently aided by satcoms, such as those used by the UN agencies (UNDP, UNICEF) or private or government relief organizations, e. g. Save the Children Fund.

ABOUT INMARSAT

1. The Inmarsat Organization

Inmarsat is an internationally-owned cooperative. As of October 1993, it has 71 member countries, who own shares in Inmarsat via their Signatories. Established in 1979, it is the only global provider of mobile satellite communications for distress, safety as well as commercial applications at sea, in the air and on land.

Inmarsat comprises three bodies: the Assembly of Parties as the highest organ; the Council, consisting of 22 representative Signatories, acting in a fashion similar to a Board of a company; and the Directorate. The Inmarsat Directorate is headquartered in London, with about 600 people of some 50 nationalities.

Inmarsat Signatories, typically major telecommunications companies, maintain additional staff in their own countries. Most customer enquiries are handled by them or by appropriate service providers and service integrators. Other important entities essential to functioning of Inmarsat are the Routing Organizations (one per country), dealing with the satellite terminal commissioning applications, and the Accounting Authorities, which, together with the LES operators, attend to billing and accounting matters.

2. Communications via Inmarsat

Through its Signatories, Inmarsat offers several different mobile communications systems, interconnected with the public switched networks. Public services provided through the Inmarsat system conform to agreed international standards. They enable the mobile user to roam and operate throughout the world, subject only to national licensing requirements where applicable. This is an important benefit for the disaster relief user as the same equipment can be used all over the world.

Operating through a variety of type-approved terminals - mobile earth stations (MESs) - Inmarsat provides a full range of telecommunications services including direct-dial international telephone, telex, facsimile, electronic mail, data communications, as well as 56/64 kbit/s High Speed Data Service. Connection can be made into the public networks, or between two or more Inmarsat mobile terminals.

Most countries today allow importation of mobile terminals for disaster relief without any limitations, or only with a minimum licensing or regulatory requirements. Inmarsat is working closely with the international regulatory bodies and regional telecommunications organizations

(eg. ITU, CTU, PATU, APT, CEPT) towards removing all barriers to free movement of mobile satcoms, so essential to emergency and relief work. PAHO in particular has been able to persuade governments of most of its member states to allow free movement of Inmarsat satellite terminals in the Americas for combatting major disasters.

THE INMARSAT SYSTEM

The three basic components of the Inmarsat system are the space segment, the land earth stations (LES) and the mobile terminals (MESs).

1. The Inmarsat space segment

The operation of the Inmarsat space segment, i.e. the satellites and the associated control facilities, is the responsibility of Inmarsat and is funded by its Signatories. Inmarsat uses its own four Inmarsat-2 satellites as the main operational satellites. Additional capacity is leased on seven other satellites. All of these are in geostationary orbits, serving four ocean regions for a complete global coverage: Atlantic West, Atlantic East, Indian and Pacific ocean regions. The next generation of satellites, Inmarsat-3, is being built by an international consortium. They will provide eight times as much satellite power as the current generation. The first launch is due in 1995.

2. Land Earth Stations (LESs)

The LESs provide an interface between the space segment and the national and international fixed telecommunications networks. They are generally operated by Inmarsat's Signatories. Many LESs provide a range of value-added services to their users, e.g. electronic mailboxes or access to e-mail networks. There are over 70 earth stations for various systems today, with more being built or planned (see Fig. 1 for location details). An LES handles the calls and keeps records for accounting and the subsequent billing with Inmarsat, the Accounting Authorities, or in some cases, directly with the user. Each of the four ocean regions represents an independent but interconnected network.

3. Mobile Earth Stations (MESs)

There are over 31,000 Inmarsat MESs of all types in operation today. They are purchased, leased or rented from manufacturers, their agents, system integrators or rental agencies. Some Signatories have special rental or leasing arrangements for disaster relief teams. More than 20 companies throughout the world design and manufacture MESs which conform to Inmarsat technical requirements. Given the variety of the equipment available, the user can choose one which meets his needs in terms of functionality, size, weight, power consumption, service, cost and delivery. For disaster relief and emergency assistance operations, either Inmarsat-A, Inmarsat-M, Inmarsat-B or Inmarsat-C could be most suitable. Table 1 contains a brief comparison of technical and economic parameters.

INMARSAT-A

There are now over 6,400 land-based Inmarsat-A MESs registered in some 135 countries. In addition to international relief organisations, the system is widely used by Heads of State, Government entities, agencies of the United Nations, radio, television and press, general commercial users, even private individuals. Portable and transportable Inmarsat-As are the proven, dependable system used by disaster relief teams for communications with their home base for tasks ranging from damage reports to supplies requests and personnel management.

Inmarsat-A terminals offer high quality telephone/fax/data, telex or High Speed Data (55/64 kbits/s) channels. The system provides the Inmarsat user with a very simple means of direct dialling to any telephone or telex machine throughout the world. In the other direction, terrestrial subscribers can call the Inmarsat transportable as easily as calling any other international number. Transportables can also communicate directly with each other. The recent growth of facsimile machines, electronic mailbox services and computer-to-computer data exchanges via telephone voice-band modems is now as common with transportable Inmarsat-As as in the office. Photos, slow-scan video and compressed video can be transmitted from terminals with the installed HSD/DHSD option. Larger antenna models enable lower cost communications and multichannel models with up to 4 channels are available.

INMARSAT-M

In response to demand for smaller, lighter and cheaper mobile satellite telephone, Inmarsat has developed Inmarsat-M. This latest system in service is fully digital. It is designed to provide good quality voice, as well as fax and data transmission at 2.4 kbit/s. An Inmarsat-M terminal is lightweight (8-14 kg including a battery), and is cheaper to operate than Inmarsat-A. A multichannel version will be available.

Commercial telephone service is already available in all ocean regions; fax and data will follow by the end of 1993. Several manufacturers offer briefcase terminals, which are the smallest voice satcom terminals in the world. Easy portability, operation from a battery and lower overall cost of operation makes Inmarsat-M a very strong candidate for emergency and disaster relief communications.

INMARSAT-B

Inmarsat-B, also becoming available in 1993, is the digital successor to Inmarsat-A. It offers increased functionality at lower charges. This fact will be particularly welcome by high volume users, as well as many potential new ones, especially those requiring a wider range of new services based on its higher data rates.

Very high quality voice is provided, along with fax, telex and data up to 16 kbits/s. One compact portable terminal, already marketed, weighs around 18 kg, comparable to the lightest Inmarsat-A. Its advanced polymer case is watertight when packed, rainproof when deployed, and can withstand a 30-inch drop on concrete. A High Speed Data facility is designed to be standard: it can support up to 11 simultaneous telephone or up to 20 data channels. This would be especially helpful in situations where a large volume of calls and faxes need to be accommodated. Inmarsat-B will also be available in multi-channel versions.

INMARSAT-C

In situations where sending and receiving written message is preferable to voice communications, Inmarsat-C is a cost-effective alternative. Inmarsat-C is an advanced, flexible packet-data communication system using a small, low-cost mobile earth stations. They can be either carried by an individual, or be mounted on a vehicle. The briefcase or portable terminal is lighter, around 4 kg, with an integrated antenna. These terminals have directive high gain antenna to reduce the power consumption, hence they can operate with batteries. Inmarsat-C is so small and lightweight that it is now possible for each field team to carry their own system when they initially enter the stricken area. When combined with a small PC (even a palm-sized data organizer can be used!), Inmarsat-C can immediately provide the means for reaching headquarters with an accurate assessment of the situation and requirements. Received instructions can be displayed, stored in a memory or printed at a later time.

There are over 3,500 land based Inmarsat-C users today. This system provides: two-way messaging and data communications on a store and forward basis; one-way position and data reporting; polling; and the Enhanced Group Call (EGC) broadcast service able to address specific groups of users. In the disaster relief work, it is the means for sending damage assessment reports either in "free" or pre-coded format, and receiving instructions from the home base. The mobile versions in vehicles (with omnidirectional antennas) allow sending automatic position reports as well as sending and receiving messages while on the move.

The system can provide both public and private (closed user group) access. The Inmarsat-C system interconnects with any terrestrial message or data network, e.g. telex and X.25 or via a modem with a telephone network. From the mobile, a message can be delivered to any fax machine. Soon, services based on X.32 and X.400, including e-mail networks such as Internet, will be available from several LESs. Data is transferred between the mobile and LES or vice versa at an information rate of 600 bit/s. The data reporting protocol permits the user to send short messages of up to 32 bytes via a special channel at very low cost; this feature is especially useful for the mobile or vehicle position reporting. Several companies are marketing complete kits for portable use based on the popular mobile terminals.

Inmarsat-C terminal coupled with sensors and operating with the data reporting and polling protocols enable SCADA - the Satellite Control and Data Acquisition. The automatic SCADA terminals can provide tsunami, earthquake, tropical storm or flood warnings. They can be powered by solar panels, batteries or other power sources. SCADA can also help in remote control of flood-prevention, for example activating flood gates.

HOW TO BECOME AN INMARSAT USER

The first step is to determine the most appropriate Inmarsat system based on the operational requirements. For example, where the highest quality voice is required, possibly combined with frequent fax requirements, an Inmarsat-B or Inmarsat-A terminal is best. Where the portability and low cost are of paramount importance, an Inmarsat-M terminal will be likely the best choice. A comparison of Inmarsat portable/transportable equipment is in Table 1.

A terminal can be obtained from each manufacturer's local agents, or from a source indicated by their central or regional office. They supply not only the equipment and after sales service, but also a commissioning form, which is in fact an application for the 'entry' into the Inmarsat system. A prospective user than sends the filled form to the Routing Organization in his/her country. This is usually the national telecommunications company. They, in turn, notify the Inmarsat commissioning system. An identification number (an 'Inmarsat ID') is issued during this process, and a brief compulsory commissioning test of the equipment is performed. Once completed, the terminal is ready for operation.

Inmarsat terminals can be used everywhere, subject to local regulations. For calling from a fixed network to an Inmarsat terminal, the caller simply dials the desired Inmarsat terminal ID preceded by a special 3-digit "ocean region" code. From a mobile, the user dials the desired fixed or mobile network number preceded by the 3-digit code for the selected LES.

WHAT THE FUTURE HOLDS

The continuous engineering and commercial efforts of the Inmarsat Partnership guarantee further improvements in size, cost and performance of all Inmarsat systems. Within the next two years, Satellite Paging is planned to be another new worldwide system for inexpensive messaging to the people in the field as well as urbanized areas. Smaller Inmarsat-M and Inmarsat-C terminals with extended capabilities are another possibility when Inmarsat-3 satellites are launched. For the 21st century, the Inmarsat Project 21 is looking into provision of small, low-cost personal communicators offering global coverage.

CONCLUSIONS

The Inmarsat global mobile satellite communications system is ideally suited to supporting disaster preparedness and relief operations throughout the world.

- **Inmarsat is independent from local telecommunications infrastructures**
  With batteries or generator power supplies, Inmarsat terminals are self-sufficient and can be in operation within minutes of arriving at the site.

- **Inmarsat provides unlimited communications as well as compatibility**
  Inmarsat is equally effective in providing communications between two independent relief teams working in the same locality as it is in providing direct links to relief agencies and material suppliers anywhere in the world. All equipment approved to operate with the Inmarsat system meets common technical standards, thus ensuring operational compatibility in the field and internationally.

- **Simplicity of operation**
  Inmarsat equipment is so simple to use that, if necessary, it can be set up and operated by untrained crew using instructions provided with the units.

- **Flexibility and portability**
  Inmarsat equipment is compact and lightweight. Many models can be hand carried.

Complete reliability
Satellites provide the most reliable communications medium, unaffected by atmospheric conditions or distance. MES operators can choose the ideal routing for a particular communication, thus avoiding bottlenecks in the event of a widespread disaster situation. The Inmarsat system is designed with reliability in mind, with many back-up facilities inherent in the system.

Table 1. Comparison of Inmarsat Systems

	Inm-A	Inm-B	Inm-M	Inm-C
Equipment cost (1)	US$25-45k	US$25-50k	US$12-20k	US$5-10k
Cost/minute (2)	US$7-9	US$4-5	US$3-5	US$1.00(3)
Overall min. weight	18 kg	18 kg	9 kg	4 kg
Battery option	no	no	yes	yes
Telephone	yes	yes	yes	no
Group 3 fax, max.	9.6 kbit/s	9.6 kbit/s	2.4 kbit/s	N/A(4)
Data typical rate	9.6 kbit/s	9.6 kb/s	2.4 kbit/s	0.6 kbit/s
High Speed Data	56/64 kb/s	56/64 kb/s	no	no
Short Data/Position report	no	no	no	yes
Multi-channel version	yes	yes	yes	no
Video transmission	yes	yes	no	no

(1) Equipment costs vary depending on manufacturer, model, type, options and place of delivery.

(2) Ranges shown are averages. Actual charges vary from LES to LES. Additional land line charges may be applicable. Discounts for off-peak, large volume users, multichannel and large antenna are available.

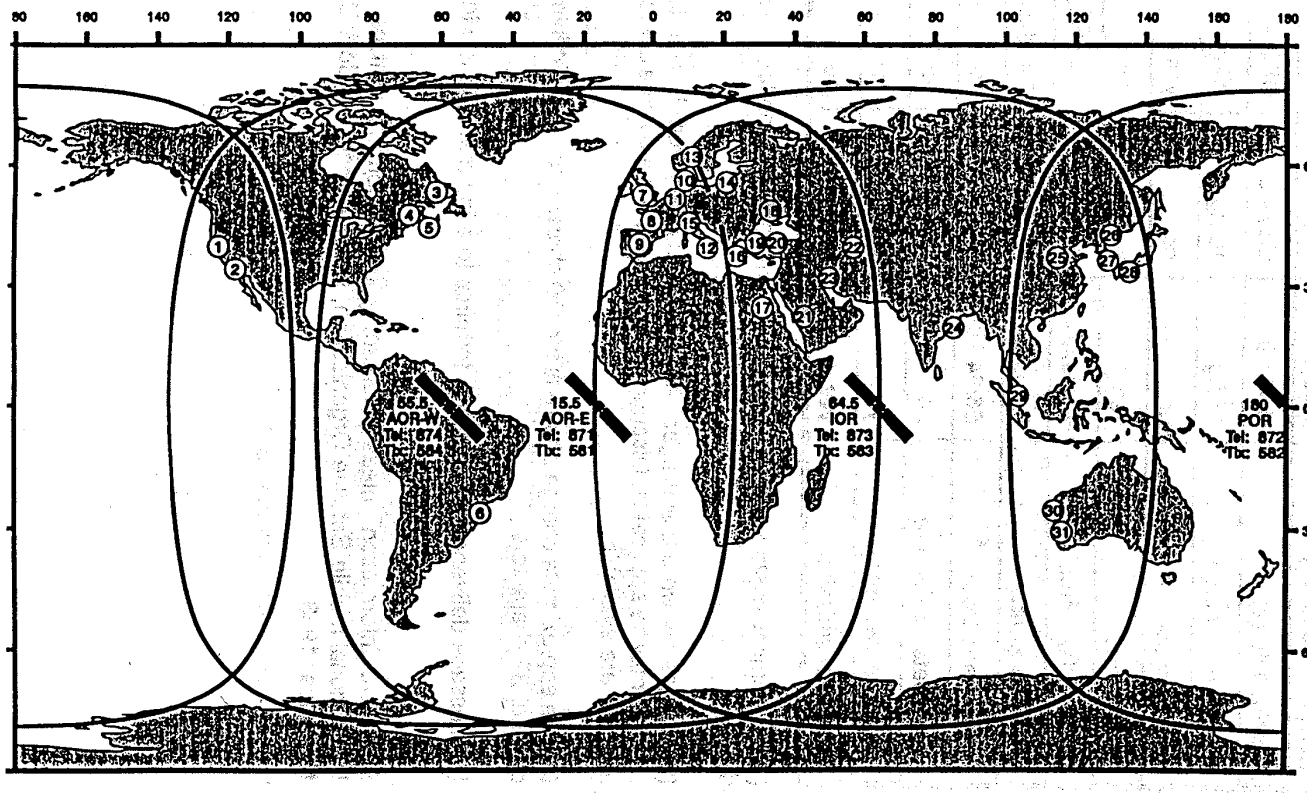
(3) The approximate charge shown is for 100 characters. Actual minimum charges are for 256 bits, i.e. 32 characters.

(4) Message delivery from a mobile terminal to a fax machine is widely available.

For more information, please contact your telecommunications company or Inmarsat, International Mobile Satellite Organisation, 99 City Road, London, UK, EC1Y 1AX.
November 1993

FIG. 1

INMARSAT SATELLITE COVERAGE



System Availability	Inmarsat-A	Inmarsat-B	Inmarsat-C	Inmarsat-M	Inmarsat-Aero
1. Niles Canyon	●			●	
2. Santa Paula	●	●	●	●	●	
3. Laurentides				●	
4. Southbury	●	●	●	●	●	
5. Staten Island	●				
6. Tangua	●		●		
7. Goonhilly	●	●	●	●	●	
8. Pleumeur Bodou	●		●		
9. Aussaguel				●	
10. Blavand	●		●	●	
11. Barum	●		●		
12. Fucino	●		●		
13. Elk	●	●	●	●	●	
14. Psary	●				
15. Reisting	●		●		
16. Thermopiae	●		●		
17. Maadi	●				
18. Odessa	●				
19. Anatolia	●				
20. Ata	●		●		
21. Jeddah	●				
22. Boumehen	●		●		
23. Um-Al-Aish	●				
24. Arvi	●		●		
25. Bijing	●		●		
26. Nakhodka	●				
27. Kumsan	●				
28. Yamaguchi	●	●		●	●	
29. Singapore	●		●		●	
30. Perth	●	●	●	●	●	
31. Ganagara	●				

278/298

DOJ EX. 1025

Tor E. Wisløff's Tabulated Overview of Big LEOs

Below are some tables of data pertaining to some of the Big LEOs (Odyssey, ICO, Globalstar, Constellation, Iridium, Teledesic and Ellipso). The tables are compiled from various general sources, all publically available, in addition to correspondance with people in the field. The further updates of the tables is dependent on me receiving information from ***you.*** The tables are compiled and maintained to be part of my Ph.D. thesis.

You are visitor number 007175 since October 11 1995.

When conflicting data entries are found, the most recent or reliable sources were used. As data are gathered from a number of diverse sources, consistency between entries for the same system is not guaranteed, nor even aimed at. Figures for e.g. system cost may entail different elements for the different systems, and serve at best as an indication only. The tables ought nonetheless be usable for comparing the systems, provided great care is taken. Blank entries corresponds to cases where no data was available to me at the time of writing

Standard disclaimers apply; neither I nor my sponsor accept responsibility in *any form* for the contents of these tables!

This work is sponsored by NERA

Orbital altitudes

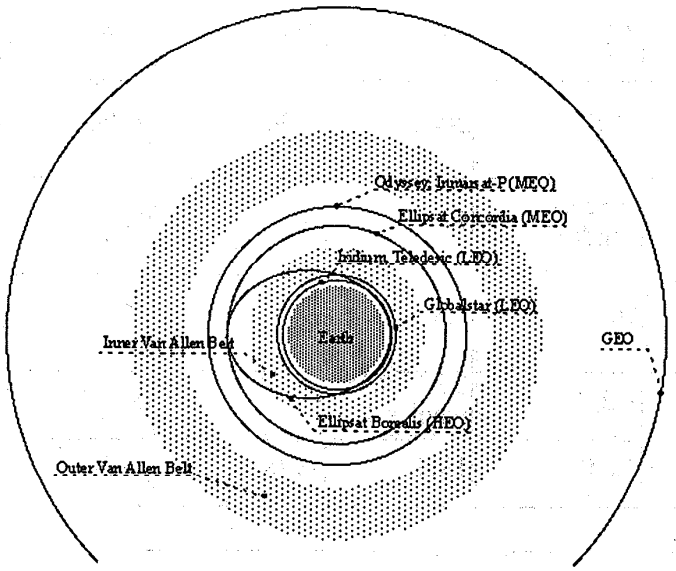


Figure 1.1 Orbital altitudes for Big LEOs and GEO. © Tor E. Wisløff

Figure is to scale (except for the ellipse shape of the Ellipsat Borealis orbit). The Van Allen belts are shown stylised in light grey.

Table 1: Services and cost

	Odyssey	ICO (formerly Inmarsat-P)	Globalstar	Constellation (formerly Aries)	Iridium	Teledesic	Ellipso
Service types	Voice, data, fax, paging, messaging, position location	Voice, data, fax, paging	Voice, data, fax, paging, short message service, position location	Voice, data, fax	Voice, data, fax, paging, messaging, position location	Voice, data, fax, paging, video	Voice, data, fax, paging, messaging, position location
Voice (kbps)	4.8	4.8	Adaptive 2.4 / 4.8 / 9.6	4.8	2.4 / 4.8	16	4.15
Data (kbps)	9.6	2.4	7.2 sustained throughput	2.4	2.4	16 - 2048	0.3 - 9.6
Modulation	QPSK	QPSK	QPSK	--	QPSK	--	OQPSK
Voice circuits / satellite	2300	4500	2000 - 3000	--	1100 (power limited)	100000 16 kbps channels	--
Dual mode User Terminals?	Yes	Yes	Yes	--	Yes	No	Yes
Hand-held User Terminals?	Yes	Yes	Yes	Yes	Yes	Portable	Yes
System cost (Million US$)	1800	2600	2000	1700	3700	9000	750
User Terminal cost, US$	300	"Several hundred"	750	--	2500 - 3000	--	1000
Satellite lifetime (years)	10	10	7.5	--	5	10	5; 5
Call rates, US$/ min.	0.65	1-2	0.35 - 0.55, wholesale	--	3	--	0.5
Operations scheduled	2000	2000	1998	1998	1998	2001	1998

Table 2: Orbits

	Odyssey	ICO (formerly Inmarsat-P)	Globalstar	Constellation (formerly Aries)	Iridium	Teledesic	Ellipso
Orbit class	MEO	ICO	LEO	LEO	LEO	LEO	HEO; MEO
Altitude (km)	10354	10355	1400	1018	780	695-705	7846 x 520; 8040
Number of Satellites	12 + 3 spare	10 + 2 spare	48 + 8 spare	48	66 +6 spare	840 + up to 84 spare	10; 6
Number of planes	3	2	8	4	6	21	2; 1
Inclination (deg.)	55	45	52	90	86.4	98.16	116.5; 0
Period (minutes)	359.53	358.9	114	105.3	100.13	98.77	180; 280
Average sat. visibility time, minutes	47.27	57.80	8.21	--	5.54	1.74	; 41.77
Min. User Terminal elevation angle (deg.)	22	10	10	--	8.2	40	10; 10
Min. mobile link one-way propagation delay (ms)	34.6	34.5	4.63	3.39	2.60	2.32	--
Max. mobile link one-way propagation delay (ms)	44.3	48.0	11.5	--	8.22	3.40	38.7; 38.7
Min. LES / gateway elevation angle (deg.)	--	--	10	--	--	40	--
Number of LESs /gateways	10 - 11	12	~100	--	15 - 20	--	--
Coverage	Major land masses	Global	Within +/- 70 deg. latitude	Global	Global	Nearly global (2 degree hole at each pole)	North of 50 deg south latitude

Table 3: Beam and re-use characteristics

	Odyssey	ICO (formerly Inmarsat-P)	Globalstar	Constellation (formerly Aries)	Iridium	Teledesic	Ellipso
Multiple access method	CDMA	TDMA	CDMA	CDMA	FDMA / TDMA / TDD	TDMA, SDMA, FDMA and ATDMA (see note at foot of table)	CDMA
Beams pr. satellite	61	163	16	7	48	64	61
Total # beams	732	1630	768	336	3168	53760	--
Beam diameter, km	--	--	2254, average	--	600 (min.)	25	--
Footprint diameter, km	10540	--	5850	--	4700	1412	; 11960
Antennae?	Steerable, earth-fixed cells	Fixed	Staring, moving cells	--	Staring, moving cells	Steerable, earth-fixed cells	Staring, moving cells
Reuse pattern (cells per cluster)	3	4	1	--	N/A	N/A	1
Reuse factor	--	--	768	--	180	20000	--
Dual satellite visibility	More or equal to 2 satellites in coverage area	Usually more or equal to 2 satellites	"Substantial"	--	At poles	More or equal to 2 satellites most of the time	More or equal to 2 satellites north of 40 deg. south latitude
Satellite diversity exploited?	No	Yes	Yes	--	No	No (gateways only)	Yes

- **Note:** Teledesic divides "supercells" into 9 cells wich are are each assigned one of 9 equal duration time slots. The cells are scanned cyclically, and the full frequency allocation is available within each cell time slots. This results in TDMA between cells in a supercell, and SDMA (space division multiple access) is used between cells scanned simultanously in adjacent supercells. Within each cell time slot, terminals use FDMA uplink and ATDMA (asynchronous TDMA) downlink.

Table 4: Frequencies and miscellaneous

	Odyssey	ICO (formerly Inmarsat-P)	Globalstar	Constellation (formerly Aries)	Iridium	Teledesic	Ellipso
Mobile downlink freq. (MHz)	2483.5 -2500.0 (S-band)	1980 - 2010	2483.5 -2500.0 (S-band)	2483.5 -2500.0 (S-band)	1616.0 -1626.5 (L-band)	Ka-band	2483.5 -2500.0 (S-band)
Mobile uplink freq. (MHz)	1610.0 -1626.5 (L-band)	2170 -2200	1610.0 -1626.5 (L-band)	1610.0 -1626.5 (L-band)	1616.0 -1626.5 (L-band)	Ka-band	1610.0 -1626.5 (L-band)
Feeder uplink freq. (GHz)	29.50 - 30.00 (Ka-band)	5 (C-band)	5.091 -5.250 (C-band)	6.555 (C-band)	19.400 -19.600 (Ka-band)	Ka-band	C-band
Feeder downlink freq. (GHz)	19.700 - 20.200 (Ka-band)	7 (C-band)	6.875 -7.055 (C-band)	5.160 (C-band)	29.100 -29.300 (Ka-band)	Ka-band	C-band
On-board processing (OBP)?	No	--	No	--	Yes	Yes	--
Inter-satellite Link (ISL) frequencies, GHz	N/A	N/A	N/A	--	23.180 -23.380	60	--
Handover performed?	Yes (only rarely)	Yes	Yes, seamless	--	Yes	Yes	Yes (User Terminal not involved)
Link (fade) margins, dB	--	8 - 12	11 - 16 dB equivalent margin	--	16 voice, 35 paging	--	--
Satellite output power (W)	--	--	--	--	--	--	200 Ave., 500 peak
Satellite mass (kg)	--	1925	< 450	--	--	--	--

Some important points:

1. The information on Constellation is outdated, and not really reliable. I do not yet know which of the data are unreliable, though... This is the only update I have got hold of, so far.
2. The data for Ellipso before the semi-colon pertain the Borealis elliptical constellation; values after the sem-colon correspond to the Concorida circular constellation. The Ellipso data are also unreliable (meaning old).
3. Be careful when comparing the data for Iridium and Teledesic with the other systems. These two systems are very different from the others. Note also that Teledesic focus on data while supporting voice. All the other Big LEOs take the oposite view, focusing on voice while supporting data.
4. This update is not complete, but all I have time for now. The next update can be expected in mid-July 1996.

Did you find any errors? Do you have more information? Comments? *Let me know!* Oh, and *please,* no "more information" or "help me" requests - I am sorry to report that I in general do not have the capacity or time to respond to such requests. I have included some of my references such that you can find more

information yourself... Although I won't normally have time to reply to comments, I do welcome feedback of any sort!

For related information, check out pointers on Brian McIntosh's excellent Mobile Satellite Telecommunications page.

Last modified: May 30, 1996

How HF radio works... in plain language.

Mark Wood G4HLZ

Very few people in the western world have not heard the story of King Arthur and his knights of the round table. Part of this story is the Legend of a marvellous sword of Excalabur, sent from heaven, and to be used for justice, good and protection. The Sword of Excalabur we don't have, but the shield of excalabur in heaven we do have.

Our earth is surrounded by layer upon layer of protection shields. The Ozone layer is one that has grabbed the headlines recently, but the earth's magnetic field also serves to create a magnetic shield around the earth to steer away charged particles from reaching the earth and thus harming life. In fact life would have been impossible without these shields in place; we owe our life and continued health to them.

Non of all this was even suspected until they were discovered in modern times, and then these things were only learned of by accident. So it was with the discovery of the Ionosphere layers. Conventional wisdom had it that longer wavelengths would have longer range. The highest practical frequencies were thought to be about 1 Megacycle, so there was very little professional interest in frequencies higher than that. In fact in 1912, the year the TITANIC sank, the famous SOS message was transmitted on a frequency of 500 Khz. Until, that is, Amateurs discovered that they were obtaining fantastic ranges from the use of wavelengths as short at 80M, or about 3 MHZ.

The reason for the old time preference for describing frequencies in terms of wavelength was that lower frequencies tend to have such long wavelengths that the antenna system had to be truly colossal. Quoting wavelength for a carrier frequency was a highly effective way to visualise the size of antenna needed, and it was thought that to visualise something would be easier for humans to grasp than to quote a cold number which can't be visualised, such as a frequency.

This explains why, when the phenomena of long range communication by radio was discovered, it was called Short wave radio; because wavelengths were shorter than tended to be used before. Do not become confused by the use of the term HF radio. This means High Frequency radio, and is the same thing exactly as Short Wave radio. Today both of these terms are hopelessly obsolete because your average mobile phone uses wavelengths about 30 cm long, and some use 10 cm and frequencies near to 2 Ghz (which is a rate of reversal of magnetic polarity if 2,000,000,000 times per second!), and no one thinks anything of it.

Another thing that confuses plain speaking people about HF radio is the constant stream of references to.. the 40M band or the 20M band that radio operators seem to trip off their tongue as if they and you were born with an innate understanding of what they are talking about. I promise you that they are trying to tell you something worth listening to, so I will now try to explain enough about it so that you can follow their conversation and still sound intelligent.

The secret of success in HF radio is..... Think from the top, down. Right then, lets start with the sun. The sun is an atomic reactor with no walls. It would be deadly for life to be so near to it as we are without some form of protection from its excesses, so that is why we need our shields of excalabur. Please indulge me if you will as I take you on a flight of fancy in an effort to describe my personal visualisation of the Ionosphere. I warn you that it is not totally technically accurate, but if you are bitten by the bug after this, there are plenty of better books explaining its gory details

Now imagine with me a Greek warrior with a round shield. This shield is not a flat disc but is actually s sort of flattened dish shape. Naturally the warrior will hold the centre of the shield towards the danger. Our shield is in fact pointing continually at the sun, this give us best protection in the direction from which the danger is coming. However our planet is rotating beneath the shield. so that at local noon we are below the centre but most of the time we are in between, passing from edge to centre in the morning, centre to edge in the evening.

My geography teacher had been a Navigator on the old HMS Warspite. He told me that communication between ships was by means of powerful searchlights, fitted with shutters so that messages could be flashed out in Morse code. However, when distances between ships were out of range of the searchlights, communication could still be kept by aiming the light at a cloud, in the direction that the other ship was thought to be, and reading the flashes from the other ship from the flashes of the cloud. Clouds are not mirrors, but the water droplets cause light to be diffracted from them, causing the light to scatter and the cloud to light up and be seen in all directions.

Naturally this required two things; There had to be a cloud in roughly the right place, and the cloud had to be high enough to be visible to the other ship from whatever range it was. The higher the cloud, the longer the range. As is that were not enough of a problem, there was also the problem of fog, mist, and daylight. The range would be short on a foggy or misty day, and (apparently) longer at night than day. This is because although the light is scattering of the clouds by day just as much as by night. The daylight is pumping much, much more light power into the cloud, which is why it has that puffy white silver glowing look. Therefore our poor puny signal is being swamped and our eyes can't detect the relatively small increases in light level caused by the searchlight. At night the opposite is true, and even the faintest flicker can be seen. In fact when passing over an uninhabited area by jet plane, you can clearly see even one light bulb picked out in the darkness.

We can apply this visualisation now to our mind model of the Ionosphere. If two places, such as London and Stockholm are out of line of sight of each other, then communication by direct line of sight is impossible. Now let us suppose we are at about 1300 GMT. The sun is directly between the two cities. It would seem that all I have to do is to beam a signal up at a spot up in the ionosphere mid way between the two places, and this will bounce down in Stockholm. Basically, yes. However there are a few problems that need discussing before we can turn our theory into a practical communications system.

There are in fact several layers to the ionosphere, not just one underside of a highly polished shield as in my visualisation. The F1 layer is the top of the shield, with another lower layer called the F2 layer lower down. Below both is a kind of electrical 'fog' layer called the D layer.

The subject of how radio waves travel is called 'Propagation'. When it is happening by bouncing off the Ionosphere, it is called 'Sky Wave' mode. The problem is that The F1 layer has a Maximum frequency above which it will not reflect the carrier wave, but let is pass through into space. This is called the maximum Useable Frequency or MUF. It is usually below 30Mhz, though it varies a great deal with solar flare activity and other factors not yet understood.

It may seem that all we have to do is use any frequency below 30MHZ and everything will be fine, but there are several problems. One of them is due to the lower layer, the D layer. It is a kind of electrical 'fog' and it absorbs radio waves. In theory this should mean that Sky wave will never work because the carrier will never get to the F1 layer. In fact though the absorption varies with frequency. The lower the frequency, the thicker the fog looks, the higher the frequency, the thinner the fog.

So the Signal will 'skip' off the Ionosphere if it is high enough to reflect off the higher layers, but not so low that it is absorbed by the lower foggy D layer. Frequencies falling within this category are said to be 'in the HF band' or the 'Short wave band'. In fact it is nominally 3Mhz to 30Mhz. The main skill of a radio operator is not just twiddling the knobs on the admittedly daunting radio, but understanding the propagation for the path to the wanted station. This is such a fascinating study that many who become Radio Amateurs make it a life study, and judging by the conversations on the Amateur bands, there is always something to talk about.

It may seem that things are as easy as finding the Maximum Useable Frequency, then just using the frequency nearest to that, unfortunately it's not that simple. Remember that There is more than one F layer, well the highest ones reflect higher frequencies and the lower ones reflect the lower frequencies. This means that if you use a frequency that is too low, then it will be reflected by a lower layer, therefore return to earth much sooner and so have a shorter range. So roughly speaking, the higher the frequency, the longer

DOJ EX. 1025

the range. You might say well, big deal, I'll just use the highest frequency I can but there is another problem.

When you use the highest layers of the Ionosphere, the signal will have to travel a long way along the local horizon in order to meet the F2 layer, so the angle of incidence will be obtuse. Just like a snooker ball, the angle it meets the layer will be the same as the one with which it leaves it, so therefore it could be thousands of Km before it next bounces down on earth. In fact it could easily pass right over the heads of the people you are trying to contact. The funny thing is that you might hear someone on another continent very well, but someone in the next town not at all!

To illustrate, there was a recent case of a ship which sank in the south china sea, off Singapore. The ships distress message was not heard by Singapore Radio, but by Rogoland radio in Norway!. Fortunately the details were telexed to the rescue authorities in Singapore immediately and a successful rescue was effected. The Singapore Authorities were very embarrassed by this, and an enquiry was launched at which it was explained that the frequency had skipped over Singapore, putting Singapore into a so called Dead Zone.

If you ever find that you can't contact your local Coast radio station at all, then don't be afraid to try a further away one on a higher frequency. Pilots testing their HF radios at Heathrow airport in London have to make test calls with Stockholm Radio, as Portishead is in the dead zone at such a short range. If you have to make an HF radio call from Near to the UK. you may have to call Stockholm radio and get them to phone the UK number for you. This is a little more expensive because Stockholm needs to charge you for an International call, but don't be afraid to do this as International rates are a small premium to pay compared to loosing contact with the PSTN. Of course if your call is not so urgent, then you can just wait a few hours for conditions to change and your contact to be restored.

As the earth rotates and we pass under different parts of the 'shield', The heights and frequencies, thickness and absorption will constantly change, with the biggest changes happening at dawn and dusk. At night the situation settles down to a more stable state. The F1 and F2 layers combine into one, and sink lower down to the ground. The foggy D layer becomes much less absorbent. The result is that now Lower frequencies can be used. The problem now is that the Dead zones become smaller than the skip zones. This is fine if you wish to have a 'Chat show' or 'Round table' conference with many stations spaced far apart. They will all be able to hear each other, no problem. The problem is that there will be so many other stations in range, that the interference from other stations will become a deafening roar, reminding one of a CB band. At night the limitation is finding a quiet frequency!.

Bands.

So what is this 'Bands' business all about? You can now see that you need low frequencies for short range contacts and high frequencies for long range ones. In fact if you don't know exactly where your next call is coming from and when, you need to be able to use several frequencies, each at least 2Mhz apart from the last. Imagine what would have happened if the ITU had allocated all ships to the band 3-5MHZ and all planes to 10-15 MHz. Ships could only make contact with stations close to them by day, and further away at night. Pilots could only make contact with stations 1000KM away by day and not be able to make any calls by night, Not too good.

More intelligently, the Whole HF spectrum was split up into bands, approximately on the lines of how they behave. Then these bands are in turn split up according to users, with a small slice of the pie to Marine, one to Military, one to Amateur and so on. Then the bands can be further split up fairly, one channel to each coast station etc. Unfortunately by the time you get this far down, there is not enough cake to go round the hungry diners, so there has to be much sharing of channels going on. How well this works depends on Gentlemanly manners, which means, it can be a Jungle out there! You may hear people saying, the Marine section of the 80M band, or the Amateur 20M band. So that you can look intelligent at Radio Operator parties, I will now explain roughly what the behaviour of the bands is like.

The 160M Amateur band has a very low frequency of about 2 MHZ. The absorption is very high by day so it is only good for cross town calls at day time. On the other hand the absorption means less interference from other towns so less competition. By night the range of this mode becomes about 500KM, but the interference becomes much more.

The 80M Amateur band Has a daytime range maybe to cover to the next town, but by night it can cross for example from the UK to Germany very well.

The 40M band has a range of about 1000Km by day, and it can be virtually global by night. It is without doubt the most useful band, which means that competition for a channel on Amateur or Commercial bands is rather fierce. This is why it can be a frustrating band with a lot of hassles, particularly at night. Look carefully and you will see an ROs face scrunch up when talking about these bands, plenty of cut and thrust to put up with.

30M or close to 10MHZ has a daytime range slightly better than 40M, and is much clearer. For example, 10Mhz is always very clear from London to Stockholm during the day, when 7-8Mhz is fizzy and scratchy. SSB is forbidden on the Amateur 10Mhz section 10.1-10.3 Mhz, but for Disaster users, as usual, there is an exception.

20M or close to 14Mhz, is not much good by night, but provides very long range service by day. It is hard to put exact figures on it thought because it uses the F2 layer and so can vary a lot.

10M or close to 20Mhz is for very long range contact by day, where it is better than 20M, but is 'Closed' by night. Some days it is not working at all. The next question is.. how do I know which Band to use?

Think from the top, down.

Suppose I am somewhere in the tundra in Scandinavia. Suppose someone comes to me saying he needs to contact a phone number in London. One way to work out what to expect is to look of the predictions on a graph. Portishead Radio and Stockholm Radio both regularly mail graphs to all of those who have personal accounts with them. My first choice in our hypothetical case would be to try to use Portishead Radio, because the landline part of the charge will be a trunk call rather than an international one. I look up the charts and find a city nearest to where I am. In fact Stockholm is probably the nearest place for which predictions exist. Looking along the bottom of the graph I check for the present time in GMT. The graph will show that the best frequency is 12Mhz.

Portishead doesn't have a frequency at 12Mhz so I look for the next lowest on the list, which is 10.291Mhz. My next task is to set up my antenna for the frequency of 10Mhz, try to hoist it up as high as possible as clear from buildings and trees as possible and try to point it in the direction of the UK. Next I will bring the radio to the antenna, and connect it up to the feeder. Then I have to bring the battery or generator close to the transceiver. Now I must tune the antenna in conjunction with the ATU type I have. I do this by transmitting plain carrier from my TX, but at very low power, while adjusting my ATU for lowest SWR. How you do that depends on the make.

Now I just press the talk button on the mike and say "Portishead radio, Portishead Radio, this is Aidman, Aidman on 10.291... over ". Then nothing happens. After about 15S there may be a whistling noise, followed by a voice saying, "station calling Portishead go ahead". You see the Radio officer at Portishead is in a horseshoe shaped booth surrounded by hissing speakers, one connected to each of the dozens of frequencies he listens to. He may be busy dealing with someone else, or talking to one of his colleges at the time you call, so If you don't get a reply, keep calling and calling with about 1 minute intervals for at least 5 mins.

When you do have his attention his next question will be "where are you". He needs to know this so that he can select the best receiving antenna for the direction that you are in. Reply rather verbosely so that he has time to twiddle the antennas a bit and compare them for best signal. It is this ability to use directional antennas at commercial coast stations that it the reason for their success.

You would then say something like, " I have a link call for you to a London number, please transfer the charges advise the charge, and warn me when 5 mins is elapsed. The number is 0123 456 7890" He will then read back the instructions to you and then try to dial the number for you. The next thing you hear is "Go ahead", and the voice of the person on the Landline phone. You will need to use Simplex procedure, but the landline person is not required to do anything other than say 'over' or something else when they have finished their turn.

The radio officer knows when the call is finished because a light lights up on his control panel when the called person hangs up. So when you think the call is over, say "please hang up now" very firmly. You meanwhile stay on the channel. After a further minute or so the RO will come back and say, "that was a 3 minute call charged to the number".

If that straight forward example doesn't work, probably it means that the Propagation predictions were not accurate enough for today. Predictions are like weather forecasts, sometimes they are spot on but sometimes not. A good Radio Operator knows this and so takes advantage of every opportunity to test propagation throughout the day in order so see if things are as they should be.

One easy method is to look for a broadcast signal from the area where the cost station is. For example try tuning in the BBC World Service, if you are interested in Portishead. Another Idea is to listen for Telex Idle tone from the coast station concerned. You can read this by ear with practice because there is a Morse code identity signal every 5 seconds, but this takes practice. Or you can listen for a traffic list from the station if it transmits them. A traffic list is a spoken announcement where someone reads out a list of stations which have calls pending.

Now suppose I am already set up at a base camp and I am expecting calls from other HF radio stations, but I don't know who, from where or when. A much more tricky problem. If the station calling me is quite close, or it is night, then I should listen to my lowest frequency, If the station is far away and it is day time, I will need to listen to my highest frequency. There are two strategies to solve this problem. Watch keeping and scanning.

Watch keeping means listening to one frequency for say the first quarter hour, another the next quarter hour and so on. The problem is that the calling station needs to know the sequence or he could keep calling on deaf ears. The other problem is that if only one band is open, and I miss the watchkeeping segment for that band, I may have to wait for a hour until my next opportunity. This is not a good method and should be avoided unless you have no scanning function on your transceiver.

Scanning is a much better strategy. You programme your transceiver to listen to several frequencies, one by one at 3 second intervals. If you are scanning four frequencies, then the sequence will take 12 seconds. Your people at the sending end will need to know this so that they can make their call for at least 15-20 seconds so that the scanner will have time to find them, and there still be enough words in the message for the Radio operator to hear that the message is for him.

You may smirk at you Radio Operators constant playing with his equipment and childishly calling people up saying, Alpha bravo this is Charley delta, you are strength 5 by 9 on a inverted vee dipole... etc. But this is the sign of a good RO. He will always know just what frequency to use when there is an urgent need for communication, because he understands the local propagation in your area.

Now you can join in his conversations and make him feel less lonely.

In the **Phonetic Alphabet**. Special words have been chosen to represent each letter of the Roman alphabet. They were chosen because they are hard to confuse and easy to pronounce. Use these words when spelling things out.

Alpha	Foxtrot	Kilo	Quebec	Victor
Bravo	Golf	Lima	Romeo	Whiskey
Charlie	Hotel	Mike	Sierra	x-ray
Delta	India	Oscar	Tango	Yankee
Echo	Juliet	Papa	Uniform	Zulu

Mark Wood.

Intentionally Blank.

TO WHAT EXTENT IS THE NORMAL PUBLIC CELLULAR PHONE SYSTEM OF USE IN A DISASTER SITUATION ?

Reprint of an essay written for the Emergency telecomms news group, ITU Geneva.

By Mark Wood DRCF.

As it happens, my 'day time job' is teaching Cellular phone systems at the Ericsson Technical Training Centre in Stockholm. I have access to very large volumes of information on this subject, you are welcome to ask for any books and training manuals to as deep a level as you wish, courtesy of Ericsson. However I know you don't have time to read all that so I now present a summary of my research into this question.

As I see it there are several issues

Capacity of the system.

Subscription to the system.

Survival of the system.

Capacity.

The problem is as always, spectrum. These days it is usual for a government to allocate a frequency band for mobile telephony which is an international standard rather than a national one. In the past countries having their own national standards have come across big problems due to the small market for their mobile phones, and the relative expense of modifying mass produced models. South Africa for example have now scrapped their own allocation and cleared the GSM band of military users in order to benefit from the mass market equipment, which is cheaper, that the GSM system brings.

The GSM band has only 124 carrier channels. As one carrier carries 8 voice channels (known as traffic channels) this gives a capacity of 992 voice channels. Sadly, the situation is not as good as this because the government may allocate two or even three operators in the GSM band (for instance), so the operator has only 41 carriers to himself, a total of 320 traffic channels. The operator has several hundred thousand customers, of which about 5-10 per cent will be making or receiving calls at any one time.

This is made possible by the cellular concept.

Building a base station is rather expensive, so the operator tries to build as few as possible. This does not mean that he can do that in the traditional way, by building stations high on a hill with a big mast. The reason is.. frequency re-use. In order to achieve the capacity needed, the frequencies used in the coverage area of the station (the cell) have to be re-used. How often this is done varies, but it can mean frequency re-use every 7th cell. Therefore any cell cannot use a frequency of a cell adjacent to it, or co-channel interference would be the result. If we take an allocation of 44 carriers for instance, this means only 5 carriers per cell, or only 40 voice channels at the very maximum. Normally the biggest cells at this time have a capacity of 32 traffic channels at most. This situation is about the same for all systems.

In a normal situation, about 5-10 per cent of users in a cell are making calls, this means that there can be only 600 or so actual users in my cell before it can be considered to be overloaded.

Because there is no way to increase the capacity of the cell by adding more carriers, the only response is a cell split. This means splitting the cell into three smaller ones. This is not as easy as it seems because then the co channel interference problems become complicated, and the situation can be worse not better.

The job of fixing this problem is done by highly skilled specialist called cell planners, who use sophisticated computer modelling tools to predict what will happen.

The bottom line is that the operator has to build more base stations, he has no alternative. This can take quite some time while negotiations with landlords are finalised before the builders and engineers can move in. Its slow and expensive.

This explains why cellular systems are nearly always loaded right up to their maximum

capacity, which is why they are poorly suited to handling emergency overload situations such as the autobahn pile up.

However there are some things we can do about it if we find our system overloaded. When the base station finds that it is overloaded, it responds by telling the mobiles not to request service for a while, otherwise it will be fully busy listening to requests for service and have little time for setting up calls.

However on command from the Base Station Controller, the base station can command only MOBILES FROM EMERGENCY SERVICES to request access. Therefore emergency services would have service as priority over normal users in that cell. As far as I know, this is rarely done. The result would be a large loss of revenue for the operator not to mention angry customers who did not get service because they did not have the special numbers. It is a complicated issue which no one likes to talk about and perhaps it is one that WGET would like to take up in the future with the operators. Of course our mobile would have to have the right number for this to work.

Another strategy is, where it is possible, to try to get the phone to change network to that of another operator. This is done by menu on the phone. Perhaps the other operator's base stations are less overloaded, anyway it is worth a try.

Overload problems can be made worse by some users such as journalists who once having seized a circuit, hold it all day if they have to keep the link to the studio. This is expensive but effective. However it will mean that traffic channel will not be released for other users for as long as it is held. Particularly vulnerable are rural base stations, which though having the same capacity as city ones, have much larger areas to cover. I could mean that a gaggle of journalists 10 or 20 KM away are saturating the whole cell and effectively reducing the capacity of the whole cell. In the city this is less so because the mobile phone is programmed to scan around for a working cell if the one it has tried is saturated and it is likely that one will be in range.

As a comparison, the maximum area of a cell is about 35KM radius from the base station. Remember only 600 users is considered to be a good figure for that cell! By contrast the city cell may be only 1K radius, with another base station 2KM away. In an urban environment a drive away from the journalists of 1Km may fix the problem, but in a rural environment you may have a long drive to escape the congested cell. An external antenna may help your mobile to see another cell which is less congested.

Each operator has a different business strategy, and he will tell his cell planners accordingly. This information is highly commercially sensitive, as knowledge of it can give a competitor and advantage. An operator will never reveal his cell plan to anyone so it is therefore near impossible to say what the service is like in any place in an overload situation. Not only that but the work of cell planning is continuos and highly dynamic, so a bad spot in one month may be the best the next month as either the capacity of the base stations is boosted, or new base stations are built.

Subscriptions

When you switch your mobile phone on, it will try to scan around the band looking for 'broadcast channels' from the base stations in range. These give details about the network that is in range and the rules about using it. The mobile will then try to 'log on' to that network. The base station will set up a dedicated data channel from the mobile phone to the Base Station Controller, which will then decide if it will grant you service or not. This is where your problems start!

If you bought your subscription to this region or area, then the BSC will know you and after checking if you have paid your bill, and that your phone is not stolen etc. etc., will register you in its home location register. Now you can make calls and receive calls from land line users. This is when your green light on your phone comes on so reassuringly.

If you are not from this area, things are different. The BSC will inform a system called the Mobile Services switching Centre that you are a visitor to the system. This will try to contact your home base computer in the region where you are registered. It will ask your home base if you are allowed service and will only give service if you are. For this to happen, there has to be a 'roaming agreement' between the system you are now

using and your operator at home. In fact most of the GSM operators in the world have such agreements with each other, but some of the cheaper operators do not (that is why they are cheaper). You should check when you subscribe, exactly who your operator has agreements with. Naturally this will not work at all if the communications lines to your country of origin are down.

All of this assumes that the system you are using has such an international roaming system. In fact few systems other than GSM do so. What is more, many countries such as the USA do not have GSM and have decided never to have it but install incompatible systems of their own. This was the case in Japan for example.

This bring me to the next problem. If for some reason the phone you have brought will not work, then you will need to purchase a local model phone, and have a valid subscription for it. This will be very hard because if there are shops open, the local people will have beaten you to any remaining phones. If you have bought a phone, validation is done electronically and if systems are down it may take a few days to get you a subscription.

Survival

Even if the base station itself survives the disaster in tact, it cannot work alone and other services must also be working. The most serious problem is power. A typical base station has battery back up for max. 8 hours without mains power. If the mains is off in the area for longer than that, the operator can bring in a generator sometimes. Usually there is only one mobile generator per BSC, that is for several hundred base stations. If there is widespread disruption of the mains power, then he can't sustain them all. A typical base station consumes about 6KW of power, plus air conditioning systems.

The base station also need a working digital link to its parent base station controller (BSC). In most cases where the base station has survived a disaster, it is equipped with a microwave link directly to the BSC. But this is not always so. Often there is a landline to the local telephone exchange, followed by a long trip through the PTT's barer network over many multiplexors and repeaters before making the BSC. If any of that is not working.., well sorry.

There is also the BSC. This has diesel back up and is unlikely to be affected by mains failure. However the links to the outside are usually by landline, and the MSC may be some distance away. If the MSC is cut off, then calls between mobiles are possible but calls to landline phones are not.

Mobile operators are aware of these problems and so there are emergency recovery plans being drawn up. These feature 'cell on wheels' and even 'switch on wheels' solutions. However the biggest problems may in the end be with transmission and power to the site, and in any case it could take days to set up such a system.

Despite all of this, experience shows that the Cellular systems are quite good at surviving disasters and providing service to users, provided that they do not become overloaded, as is often the case.

Furthermore the overloading situation is worse in situations where phones are in private use rather than business use. Business tends to be suspended in the acute phase of an emergency, whereas private matters become more acute. In the future more private users than business users will be on line, so the overloading problem will be more severe.

Mark Wood DRCF.

Data over INMARSAT terminals.

A tutorial by Mark Wood and Brian Garstang.

The Disaster Relief Communications Foundation.

OCT 14 1996

With the rapid acceptance of electronic mailing, facilitated by the Internet system, and the seductive promises of the potentials offered by the World Wide Web system, many disaster relief and aid agencies are seriously turning their attention to the question of using data services as part of their field operations.

Quite aside form the question about what kind of data we may want to transmit and from where, the most important questions are: How ? How can it be done ? How much will it cost ?

This tutorial addresses these questions in the context of Inmarsat services. These services use satellites to provide mobile communications as an extension of the terrestrial telephone and data networks.

Inmarsat operates different services that have different capabilities for different costs. Each service requires a mobile terminal with different characteristics. For data transfer there is some overlap between data capabilities and costs across the services so choice of the service depends on what you want to do with it.

Inmarsat A

Inmarsat A is an analogue system. This means that it acts purely as an extension of the the telephone network and anything that you use to communicate over a phone can be used over Inmarsat-A.

So, as well as using the mobile Inmarsat-A telephone for voice, it can be used for communications between a modem at the mobile and a modem plugged into a telephone line anywhere in the world. Similarly, any fax machine can be plugged into the mobile terminal and used to send and receive faxes from any other fax machine in the world.

Data rates

As the communication is going over the Inmarsat satellites, the data rates between two modems can be lower than if these modems were calling over the telephone network in the same city.

Achievable data rates are around:

Fax: 9600 bit/s (which is what most fax machines achieve in the rest of the world).

Cost :

Mobile terminal : $ 13,000 - 30,000
Phone : $2.90-10 / minute
Telex : $2-4 / minute
Fax: as phone
Data : as phone

Inmarsat-A can also be used for connection to High Speed Data services that have applications for audio journalism (radio reporting), video journalism (using store-and-forward digitised video data), videoconferencing, high speed fax transfer, data collection and software uploading or downloading. Current speeds available are 56 kbit/s and 64 kbit/s. Some services allow interconnect to ISDN.

Telex services - very few people outside the maritime community use these.

Inmarsat B

Everything said about Inmarsat-M (below) applies to Inmarsat-B apart from that Inmarsat-B is larger, heavier and costs more to buy. However, the trade-off is that it provides extra bandwidth channels and 9.6 kbit/s fax and data services can be supported, making call charges cheaper as you are using it for les time than you would to make the same call over Inmarsat-M. If you are doing a lot of data communications, then this is the one to go for.

Cost :

Mobile terminal : $ 20,000 - 30,000

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Phone : $2-7 / minute
Telex : $2-4/minute
Fax: as phone
Data : as phone

Inmarsat-B also supports High Speed Data Services (see notes in Inmarsat-A section) up to 64 kbit/s.

Inmarsat M

Inmarsat-M is an evolutionary step from the original Inmarsat services. By making the mobile terminal smaller, lighter, cheaper it has become possible to install it into a briefcase, costing around US$10,000 and appeal to a wider market. The downside to the reduced size is that the data rates that it can support are much less than Inmarsat-A and Inmarsat-B.

The Inmarsat-M service supports fax and data services in addition to the voice service. These are all digital services, which means that instead of transmitting voltages that are related to voice, numbers are transmitted that are related to the voice.

The problem here is that when this voice coder tries to change signals that it receives from a modem or fax machine into numbers it discovers lots of problems. This is because the coder is optimised for voice (and called a voice codec) and can not be used for data or fax transmission. As a consequence, Inmarsat-M mobiles use extra channels that are optimised for data and fax communications.

So, each mobile will have one channel for voice, one for fax and one for data services. Each channel will be optimised for that service and have its own telephone number. The telephone numbers and channels are not exchangable between services - you will not be able to run the fax machine through the voice or data channels.

You can directly plug any fax machine into the mobile (into the fax port, that is) and send and receive faxes from any other fax machine connected to a telephone network.

For data services, you do not need to plug a modem into the mobile. The Inmarsat-M mobile pretends that it is the modem and you can plug your PC into the mobile and in principle run it as you would through any modem. However, similarly to modems displaying individual characteristics, it has been found necesary use special versions of PC software that are optimised for Inmarsat-M mobiles. These special versions of common software packages (e.g. Compuserve, MSMail) can be found on the Inmarsat Web site under :
http://www.inmarsat.org/inmarsat/

Data rates for Inmarsat-M fax and data services are a maximum of 2400 bit/s, which is one of the lowest speeds most modern modems support. If you are doing a lot of data communications and you are not worried about increased size then you should use Inmarsat-B.

Cost :

Mobile terminal : $ 8,000 - 20,000
Phone : $3-6 / minute
Fax: as phone
Data : as phone

Watch out for - the Inmarsat Mini-M service (Inmarsat-phone), due for launch late 1996, where the mobile terminal will be around the size of a laptop PC. The data services will be identical to those described in this decription of Inmarsat-M.

Inmarsat C

Inmarsat-C is a very versatile system for data communications as is small, light, cheap. Because of the reduced size, it can not carry voice so can not be used as a telephone. It can be thought of as a modem into the various data networks - simply plug your PC in and off you go.

Inmarsat C works in a way so completely different from the others that it was not safe to write about it in alphabetic order, but rather it must have a separate description of its own.

Inmarsat C is a store-and-forward system. To explain that, I will have to say something of the difference between this and the circuit switched strategy as used in standard A, B and M.

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Data over INMARSAT

A telephone system is a circuit switched system, when you dial, you get a circuit, private to you, from one end to the other. You pay for this circuit by time, whether you use it or not. If you hook up to a bulletin board with a modem for example, then read a long message while still connected, you are paying for something that you are not using (not very good.)

When you use a store and forward system, you only pay when you send or receive data, not in the mean time when you are reading it. This explains why store and forward is used in the Internet system.

Just as there is a public telephone system, there is also a public store and forward data system, called the Public Packet Switched Data Network. (PPSDN). It is sometimes called the X25 system after the ITU recommendations upon which it is based. This is the system used when moving data where there is not a continuous stream of data, such as for shops checking your credit card authorisation.

Inmarsat C is a store and forward system, or if you like, a packet data system. Packet systems get their name from the way they chop your data into packets with the contents on the inside and the address on the outside. Like a postman, the system reads the address on the outside so he knows where to send the message, but does not read the message on the inside.

The fact that the amount of channels that the satellite needs to serve even large numbers of Inmarsat C users, is quite small compared to telephony, is the reason why it is so much cheaper. It also explains why it is more reliable. At busy times the only problem will be delays in waiting for a turn to use the system, but sooner or later, it will get through.

Potential ways of using Inmarsat C are:

- **telex** - to and from your mobile terminal to any telex machine;
- **fax** - text messages can be created and sent from your mobile to any fax machine. Note that it can not be used to send faxes from a fax machine to the mobile;
- data messages can be sent from the mobile to any modem, and also from any modem to the mobile;
- **e-mail** messages can be sent and recived over the Internet or X.400 services;
- data can be sent or received on the X.25 network - although limited to a store-and-forward system;
- **data** reporting and polling service can be used as a telemetry/telecomand service for remote monitoring services, e.g. water levels, vehicle location.

Cost :

Mobile terminal : $ 5,000 - 10,000
Telex : $1 - 1.50 / kbit
Fax: as telex
Data : as telex

Mark Wood / Brian Garstang, DRCF.
OCT 14 1996

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APCO International

The Association of Public-Safety Communications Officials - International, Inc. - APCO International - is the world's oldest and largest not-for-profit professional organization dedicated to the enhancement of public safety communications.

With more than 12,000 members around the world, APCO International exists to serve the people who manage, operate, maintain, and supply the communications systems used to safeguard the lives and property of citizens everywhere.

APCO Institute

APCO Institute is a not-for-profit subsidiary of APCO International providing customized education and training programs, technical and operations publications, and information services for APCO International members.

APCO's professional instructional designers can write and produce customized training programs to meet specific needs of your agency. APCO Institute can do job analysis, needs analysis, and also can bring the experts to your agency to do a site inspection and make recommendations to efficiency and other factors. APCO Institute's personnel can analyze the job of telecommunicator, supervisor or almost any other job and design an applicant-screening device that can be used to screen those interested in the position.

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