# NEW TECHNOLOGIES IN HUMANITARIAN EMERGENCIES

### Description

Most disasters occur in developing countries where the technology infrastructure is limited or non-existent. Even though high-level or sophisticated technology save more lives in developed countries, only technology that is easy to use, durable, inexpensive, and field-tested should be introduced to a relief operation. Otherwise, existing constraints can cause sophisticated technology to be left idle. This chapter reviews various technology-based approaches and tools that can enhance the effectiveness of disaster operations.

### Learning Objectives

- To discuss the main concerns about introducing new technologies in relief operations.
- To define the levels of communications essential in relief operations and the technical solutions for each level.
- To discuss different uses of computerised systems for information management and health care.
- To define how geographic information systems (GIS) and global positioning systems (GPS) are used for disaster mapping.
- To describe different types of high-level medical technology and its application to the disaster environment.
- To define the technology available for predicting weather forecasts.

### Key Competencies

- To recognise the limitations of new technologies in relief operations.
- To design a basic communications systems for a relief operation.
- To understand how information management and health care can be improved through computerised systems.
- To use geographic information systems (GIS) and global positioning systems (GPS) for disaster mapping.
- To understand the importance of high-level medical technology in the disaster environment.
- To select appropriate technology for predicting weather forecasts.

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## USE OF NEW TECHNOLOGY IN EMERGENCIES

Disasters place great demands on humanitarian workers, particularly when they occur in locations with poor communications and information systems, and low quality health care. The potential of relief operations can be enhanced by new technology, such as telecommunications, computerised systems, and medical technology. However, great caution must be taken when introducing new technology in emergencies. The table below defines commonly used technology terms.

*Table 13-1: Terms and Definitions*

| | |
|---|---|
| **Appropriate Technology** | Emphasises that the most sophisticated technology is not always the best for a particular situation. Important factors include lifetime cost, durability, training requirements, ease of use and maintenance. |
| **Computerised Systems** | Computer hardware and software used to support an information system by storing and retrieving large amounts of information. |
| **Computer Hardware** | The actual machines – desktop and laptop computers, printers, etc. |
| **Computer Software** | The programs that enable information to be stored on computers, such as:<br>• Operating systems – MS-DOS, Windows<br>• Word processors – MSWord, WordPerfect, Lotus AmiPro, etc.<br>• Spreadsheets – Lotus 1-2-3, MSExcel<br>• Databases – EpiInfo, Access, FoxPro<br>• Accounting – Scala<br>• Electronic mail – Eudora, Outlook Express<br>• Other – internet, resource tracking, mapping, weather |
| **Medical Technology** | Methods, equipment, and materials that enhance the capacity of health facilities to provide effective preventive and curative health care. The following tools can be used safely by health workers at health centres:<br>• "Dipsticks" or saliva tests to diagnose HIV, STDs<br>• Non-invasive diagnostic tools: ultrasound machines<br>• Single dose oral treatment: for STDs, worms, measles, polio |
| **Telecommunications** | Any transmission, emission or reception of signs, signals, writings, images and sounds or intelligence of any nature by wire, radio, optical or other electromagnetic systems (International Telecommunications Unit). |
| **Telecommunications Tools** | Radio, telephone, telex, telegraph, telefax, satellite and data transmission |

New technology has been introduced in various developing countries. However, it may not always produce the expected results. The table below lists the advantages and disadvantages of introducing new technology.

*Table 13-2: Advantages and Disadvantages of New Technology*

| Benefits of New Technology | Problems of New Technology |
|---|---|
| • Faster<br>• Smaller<br>• Cheaper<br>• Simpler<br>• Fewer workers<br>• Increased productivity<br>• More efficient<br>• Increasingly digitised<br>• Increasingly mobile | • Too complex for some workers<br>• Equipment may have to be imported<br>• Need training to install, use, and maintain<br>• May result in loss of jobs<br>• May require utilities (electricity, water, etc.)<br>• Under-use/misuse/over-use<br>• Increasing dependency<br>• Not resistant to dust, humidity, heat<br>• No spare parts locally<br>• Needs a maintenance plan/budget |

## Assessing Technology Needs

Most problems with new technology occur because of *poor planning and understanding* by decision-makers, *inappropriate expansion*, and *insufficient maintenance*. Before introducing new technology, it is important to carry out a proper assessment of the technology needs, the local environment and the relief workers. This will help determine whether introducing new technology is really necessary, appropriate, or sustainable.

The following steps may be used to carry out the assessment:

1. The technology unit should first advise relief planners on the benefits and practical use of new technology, as well the required maintenance in a particular emergency setting. Relief planners can then determine whether new technology is necessary for improving the quality of humanitarian assistance. If they deem it necessary, they should determine at which level within the relief operation it would be most beneficial.
2. It is important to assess the types of technology in the local market and the experience of people who may have been using new technology locally. Any technology that is introduced must be *appropriate*, in addition to making work more efficient and effective. It must fit the environment in which it is used.
3. After selecting any new technology that is to be introduced, planners should assess the ability of relief workers to use the equipment properly and the level of training required. The most common cause of equipment breakdown is improper use, which is usually related to lack of training.
4. Because maintaining imported technology in developing countries can be difficult, the capacity to maintain technology should be assessed, in terms of skills of technicians, infrastructure, communications, spare parts, and funding.

## Adopting New Technology

Any agency that is considering using new technology in relief operations should consult its technology unit. This is because successful adoption of new technology in a relief operation is a complex process. It involves procuring new equipment, accessories, and supportive equipment (e.g., generators, air conditioning systems), providing training and technical support as well as defining the operating and maintenance procedures.

The following steps can help ensure successful adoption of new technology to a relief operation:

1. Establish a technology unit to co-ordinate all technology-related activities. This should include anyone who needs to be involved (e.g., finance, administration, human resources, logistics). This multi-sectoral team can help develop policies about new technologies in emergencies.
2. Establish a suitable and understandable action plan for managing the equipment (installation, training,

procurement of supplies, infrastructure requirements, maintenance, etc.).

3. Train and supervise staff who will install, use, and maintain the technology.
4. Introduce and enforce operation and safety procedures to everyone who will use the new technology.
5. Provide access to technical support for all users.
6. Ensure easy availability of consumable materials, similar equipment, and spare parts.
7. Budget for consumable materials, maintenance, and repair services. Materials and equipment should require minimum maintenance or should be maintained by regular (non-specialised) staff.
8. Make efficient and cost effective use of the technology.

### Technology Maintenance

Maintenance should be a key factor when introducing new technology. A relief operation will usually not be able to support the training of special technicians or pay high wages for repairs. The technology unit at the headquarters should decide on the following:

- a maintenance budget (about 20% of the value of stock should be adequate on an annual basis)[1]
- training in technology maintenance at the local level
- where to send equipment for repair services

A maintenance plan should be developed. This should involve preventive maintenance as well as repairs. All staff members using new technology should be trained to perform minor preventive and repair work. This is because most of the maintenance can be done using very basic skills and a few spare parts. Improving access to and communications with maintenance services will ensure the technology is used properly.

## TELECOMMUNICATIONS TECHNOLOGY

Most disasters occur in remote areas where the existing telecommunications system is usually weak. To avoid letting poor communication become the major obstacle in the relief response, new telecommunications systems must be set up as soon as possible. Benefits of good communication include:

- immediate reporting of an emergency situation
- rapid mobilisation of resources to assist victims
- increased safety of field personnel
- reduced cost of referrals through consultation by radio
- more efficient evacuation of emergency cases

### Telecommunication Systems

When starting a relief operation, the existing telecommunications infrastructure should be carefully analysed. A good telecommunications system can be set up for an operation with limited resources if the following issues are considered:

- Telecommunications equipment needs to be adapted to the local context.
- Good organisation is essential if equipment is to be used effectively.
- Efficient telecommunications can be expensive, but expensive telecommunications systems are not always efficient.
- Efficient telecommunications are not normally compatible with short-term arrangements.
- A telecommunications system costs less if it consists of standard equipment that everyone in the organisation is familiar with, if it is installed professionally and provides technical support for users.

- Telecommunications services are essential to support relief workers and should be viewed with a global perspective of the humanitarian organisation, rather than for a specific operation.

The efficiency of a relief operation is greatly increased if the telecommunications system is well organised from the start. Telecommunication systems are required for all levels of the humanitarian response:

1. *International level* — to link all concerned international agencies will help co-ordinate medical and logistics operations.
2. *Region-wide level* — to create a liaison with military units, governments, and non-governmental organisations based within the region.
3. *Field level* — to co-ordinate the activities of all concerned units in the disaster site. This includes the project team, local security forces (police, military), public works, emergency medical services, fire units, and a command/control network.

## Telecommunication Tools

Telecommunication technology is developing at a very rapid pace. The table below describes various telecommunications technology and tools that may be used in emergency situations.

*Table 13-3: Telecommunications Technology and Tools*

| Telecommunications Technology | Description of Available Tools |
|---|---|
| **Telephone** | Instruments for transmitting voice messages. There are various telephone systems:<br>• Local telephone lines – may not be reliable<br>• Cellular telephone systems – available in many locations<br>• Satellite communications – provide better quality lines than local telephones |
| **Telefax** | Equipment that transmits exact copies of images or printed matter by electronic means. Requires a good quality telephone line. The telefax and telephone normally should not share the same line where the volume of communication is high. |
| **Telex** | Consists of teletypewriters that send and receive signals by telephone. The radio-telex is now more commonly used. |
| **Radio** | Equipment that allows two-way audio communication without connecting wires:<br>• Very High Frequency (VHF) radio — hand held, suitable for local voice communication over a very short range (in a city or camp); e.g., MOTOROLA*<br>• Ultra High Frequency (UHF) radio — similar to VHF but give better transmission in dense urban areas, e.g., MOTOROLA*<br>• High Frequency (HF) mobile and base units — link VHF/UHF/HF communications (voice and written) over short, medium or long distances, e.g., CODAN*<br>• PACTOR system — a special modem attached to a HF radio and computer to transmit text and data |
| **Radio Repeater** | Equipment that links VHF/UHF and HF radio users located at distances that prohibit direct radio communication. It may cause a slight delay when forwarding messages. |
| **Satellite Communications** | A variety of equipment for immediate transmission of various signals (voice, fax, telex and data messages), such as:<br>• INMARSAT M<br>• Mini M satellite systems |
| **Computer-based Communications** | Computers and telecommunications systems (telephone, radio and satellite) can enhance the flow of communication and information through:<br>• Internet (the World Wide Web) |

- Electronic mail (e-mail)

* brand name of vendors

The type of communication tool needed will depend on the desired level of communication, for example:

1. **International level communications** may require the following technology:
   - Portable satellite telephones that are widely available. The hardware is affordable, but the cost per minute of satellite transmission can be restrictive.
   - Ham radio type equipment is an inexpensive alternative (free transmission), but is subject to weather limitations.

2. **Regional communications** require equipment that is compatible among various agencies and partners. The following equipment may be considered:
   - Radio repeaters and antennas can greatly improve the range of radio communications (including the PACTOR). But installing radio repeaters requires access to a high point (e.g., a roof) and a telecommunications expert for possible breakdowns. Mobile repeaters and antennas have recently been developed (cost about U.S. $2,000.00).
   - High frequency (HF) radios need a heavy power supply, so hand held HF sets are not available. The quality of the message transmission depends on the weather, time of day, the distance to cover, etc.

3. **Field level communications** may be improved through the following technology:
   - Radio communication is cheaper to set up and use because fewer repeaters and antennas are needed. Field communication can be carried out using hand-held VHF/UHF radio units and base stations that are moderately inexpensive. However, all these systems require electricity for operation and battery charging.
   - The telex may be the only means for communication in some emergency settings. The machine should preferably be purchased or rented locally. The tape puncher/reader could be created from a normal word processor on a computer.

## The Internet and Electronic-Mail

The Internet is a matrix of computer networks. It is useful for accessing a wide range of information as well as for communication, for example:

- direct access to information from all over the world
- online search for specific information
- frequent and fast updates on humanitarian issues and new developments
- links with different organisations, institutions, individuals, etc.
- numerous training opportunities for distance education through virtual classrooms
- widespread communication through electronic mail (e-mail)

The internet must be used with intelligence and care. Many relief organisations are developing their own web sites in order to share information about their relief operations with potential donors.

Relief organisations set up email systems for their workers wherever it is practical. E-mail is a highly effective, inexpensive, and fast way for individuals at different levels in a humanitarian operation to communicate. However, it requires a reliable telephone line and computer system to be useful.

## Information Management

*The right information, transmitted quickly, can save lives and help ensure an effective response to a disaster situation.*

Humanitarian organisations are becoming more aware of the value of managing information well. The last two decades have produced rapid advances in information management, from manual to computerised systems. Computer **hardware** has evolved from large and expensive machines requiring considerable space, technical expertise, and maintenance to less expensive, portable computers that can run on batteries. In addition, computer programs, or **software**, have simplified how computers are used so that less staff training is required.

### Computer Hardware

Computer hardware is the physical equipment directly involved in the data-processing, communications and other functions. It includes desktops, laptops and printers. Most computers use the *MS-DOS* or *Windows* operating system. They may vary considerably in their data processing speed and data storage. Because computers and related equipment keep changing, no specific recommendations can be made about the most appropriate type for relief operations. Computer hardware should be selected in a systematic way that matches information management needs with the appropriate and available technology. Technical experts at the senior level should be consulted. In addition to cost, the following criteria should be considered:

- staff skills available for processing information
- local people's or group's experience with computers
- "tried and tested" computer systems in the disaster region
- commonly-used computer software programs
- availability of technical support services
- access and reliability of servicing and repair facilities
- reliability of power supplies
- existing environment (dust, heat, exposure to sunlight)

### Computer Software

An in-depth discussion of computer software is beyond the scope of this text. The following points summarise the key software considerations.

1. Standard software packages can be used on desktop or laptop computers for various information management functions, including word processing, spreadsheets, graphic design, databases, and email. The following standard software packages are commonly used:
   - *Microsoft Office — Word, Excel, PowerPoint, Outlook, Access*
   - *Lotus Smartsuite — AmiPro, Lotus 1-2-3, Freelance Graphics, Approach database, Organizer* and *CC-Mail*
   - *Corel — QuatroPro, Paradox, WordPerfect*

2. Specialised software packages have been designed for storing medical records, financial reporting, or resource tracking, etc. The following specialised software packages are commonly used:

   a. *Database software* allows the data entered to be reported in the form of text, tables, charts or graphs.
      - *Epi-Info* is a useful general purpose software that was developed by the Centers for Disease Control and Prevention in the United States in collaboration with the World Health Organisation in Geneva. It is designed specifically for epidemiological studies and is used for word processing, designing questionnaires, data entry and validation, and statistical analysis, including simple tabulations. This software is available free of charge through the Internet.

- Others — *FoxPro*, *Access*, *Excel*, and *dBase* are also good choices.
- *ANACOV* and *COSAS* — these software programs are used for analysing vaccine coverage surveys. They are distributed by the World Health Organisation.

b. *Financial software* is useful for financial monitoring and reporting. Commonly used financial software programs include the following:
   - Spreadsheet applications are inexpensive (less than US$300.00) and powerful. They can easily be used to track, record, and report financial transactions for emergency care in a disaster setting.
   - Accounting system programs that have been used include *Field Returns*, *Scala*, and *QuickBooks.*

c. *Resource tracking* is an important logistics function. Several applications can be used to record supplies on arrival, supplies stored in the warehouse, and supplies dispensed. These applications are also effective for keeping track of expiration dates on medications, or calibration dates on medical equipment. An example of a widely used software is *SUMA*, a relief SUpply and MAnagement system that can be downloaded for free from the Internet. It is useful for managing relief supplies from the time pledges are made by donors to their arrival into the disaster area, then onto their storage and distribution. Information on the supplies is collected along points on the supply chain, such as the airport or seaport, the warehouses, and final distribution point. The information is forwarded to the central level in electronic format. As a result, *SUMA* can do the following:
   - Keep authorities and donors informed of exactly what has been received by the country or region.
   - Quickly identify and assign priority to those supplies that are needed urgently by the disaster affected population.
   - Serve as a tool for inventory control on warehousing and distribution of supplies.

   **Note:** *Software applications that are linked with bar code technology have the capability of printing bar code labels for almost any device, vehicle, medication, or other relief item.*

## Staff Training

Basic computer training may be necessary for staff members who have not used computers before. Those interested in getting computer training should be encouraged to develop basic typing skills. Training them in word processing and data entry helps them to understand the problems of managing information and enables them to later assume greater responsibility. All newly trained staff should have access to on-site computer support and adequate supervision. The morale of staff doing boring tasks such as data entry can be increased by additional training in new techniques and software and giving recognition for satisfactory performance.

## Maintenance of Computer Technology

Even though computers are becoming more and more dependable, staff members should be prepared for computer breakdowns. The following measures may help to improve the performance of computers:

1. Use standard computer hardware and software within the organisation and provide technical assistance.
2. At the end of each year, check and upgrade computer hardware and software as needed.
3. Establish a methodical back-up system for copying all data files on a weekly basis on two sets of backup floppy diskettes or other backup media (e.g., printouts).
4. Purchase more than one computer, so if repairs are delayed by lack of appropriate technical assistance or spare parts, work can continue to flow.
5. Protect computers appropriately to prevent loss of information or damage through the following ways:
   - use power surge protectors and rechargeable batteries against sudden voltage fluctuations
   - use air conditioning systems to protect against excessive exposure to heat
   - have regular servicing and cleaning done only by approved computer dealers
6. Every precaution should be taken to detect and prevent contamination by computer viruses, which can

destroy the computer's memory.

- Installing software should be restricted to authorised persons.
- Floppy disks from outsiders should first be scanned before information is loaded onto the computer.
- Anti-virus software should be regularly upgraded.

## Disaster Mapping

Disasters may occur in remote locations where accurate maps do not exist. Maps may be sketched by assessment teams using aerial photographs or with a compass and tape measures. However, more accurate mapping is needed for the following two reasons:

1. Planning access routes to the disaster site:
   - Air transportation purposes — to determine air traffic routes, the nearest airports, remote airfields, and areas for helicopter landing. Important air safety features such as mountains, radio towers, and power transmission lines must also be identified.
   - Ground transportation routes must also be shown. This is important in remote regions where roads are often poorly mapped.
2. Site planning:
   This is necessary because space is usually a limiting factor when planning a humanitarian operation. Scarce land must be divided to allocate space for various facilities, water resources, warehouses, medical units, and shelters. A construction manager must have an accurate picture of everything in order to allocate and control the space.

The following tools are available for disaster mapping:

- **Global Positioning Systems (GPS)** are inexpensive (approximately US$200.00), hand-held tools that are based on satellite technology. They use signals from three or more satellites rotating around the earth to track down the geographic location (in terms of latitude and longitude co-ordinates) of a person, vehicle, house, road, etc. anywhere on the earth. Most GPS receivers can store up to 100 data recordings. To display accurate maps at the end of the day, GPS data needs to be applied to Geographic Information Systems (GIS) software.

- **Geographic Information Systems (GIS)** is software that is required to analyse geographical data that was collected using Global Positioning Systems (GPS) and display it accurately as maps. This technology has also been used to show the distribution of disease cases in epidemiological studies. An increasing amount of GIS software is becoming available for laptop computers, for example *EpiMap*, *MapInfo*, *POPMAP*.

## Weather Technology

Extreme weather conditions may be the root cause of a humanitarian emergency, or a major constraint to humanitarian operations that involve a political/military refugee scenario. There are dozens of weather tools and forecasts available on the Internet at no charge. These include satellite images, weather maps, forecasts and discussions for any location in the world. The requirements for computer and software are basic. However, access to the local telephone system or satellite communications system is essential.

# HIGH-LEVEL MEDICAL TECHNOLOGY

Delivering effective health care is critical in any humanitarian emergency. In developing countries, the demand for health care is usually very heavy, yet the environment does not support the traditional health care system. Medical facilities often consist of tents without electricity or running water. Most diseases are diagnosed

and treated on a symptomatic basis. In many humanitarian emergency situations, the following medical technology are commonly used: simple microscopes and dipsticks for testing urine, blood sugar levels, and malaria parasites.

Every effort must be made to use portable and robust medical technology that can improve the capacity of an emergency health system to provide effective preventive and curative care. High-level medical technology to be considered in humanitarian emergencies include the following:

- **Rapid diagnostic tests**, e.g., "dipsticks," sputum or saliva tests for diagnosing tuberculosis, HIV, and other sexually transmitted diseases.
- **Single dose drug treatments** for STDs, worms, amoebiasis.
- **Oral vaccines** that can be given as a single dose to control communicable diseases such as measles and polio. New oral vaccines against cholera and typhoid have been developed and are under evaluation.
- **New inventions** will continue to expand the range of non-invasive monitoring equipment. Medical laboratories can be improved with equipment designed for emergency medical services and military use. In developed countries, this includes pulse oximetry, portable glucose reading, and portable cardiac monitoring.
- **Medical telemetry** is a useful tool. Physicians at a remote site can transmit images, video, electrocardiograms, and vital sign information to a distant medical facility through the computer for consultation. However, telemetry depends on an effective local telephone system or satellite telephone for transmission. E-mail is very effective for this purpose and may be corporate-based or internet-based.
- **The Internet**, which is becoming increasingly available in developing countries, offers reference materials for a wide range of curative and preventive health issues that arise in humanitarian emergencies.

Caution must be applied when introducing high-level medical equipment to the disaster environment. Not all equipment is suitable for all types of environments. Accurate calibration and the costs for operating and maintaining technical equipment need to be considered. In addition, the availability of maintenance service and spare parts are critical factors to consider in humanitarian emergencies. It is not enough to consult the medical workers (whose work may be improved by the new technology) because they may not appreciate all the technology requirements, such as training, maintenance, and community acceptance. Therefore, non-medical workers should be consulted as well as community representatives to ensure the cultural, social, and economic constraints are all considered.

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[1] Bloom and Temple-Bird. See above.