Space radiocommunications system for aid following natural disasters

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Introduction

EARTHQUAKES, floods, hurricanes, famine... natural disasters that have victimized man since the beginning of time. Powerless to avert or control them, man has suffered their consequences. They have wrought an incalculable toll of suffering and death.

But all too frequently, the aftermath of the disaster has proved to be worse than the cause. Whole communities have become the victims of disease, hunger and privation because relief in the immediate post-disaster period has been delayed. Delayed because the means of communication between the stricken area and relief centres had been destroyed; or perhaps because no communications systems existed.

Ways and means of providing help and alleviating the tragic after-effects of natural disasters have long preoccupied relief organizations throughout the world. The need for swift and effective action was clear. Equally it was clear that better methods of communication were an urgent requirement if post-disaster relief operations were to be improved.

The United Nations Organization (UN) ranked with other organizations such as The International Red Cross in its concern

to better the co-ordination and management of disaster relief. And in the late 1960s the UN General Assembly passed several resolutions, calling for the rationalization and improvement of the means employed in this vital humanitarian work. Improved communications would have to be part of the review and it was natural that the ITU as the specialized UN agency responsible for telecommunications should be requested to consider the problem and make its recommendations.

The problem...

From the outset the ITU recognized that communication between stricken areas and relief centres was unlikely to be solved satisfactorily by conventional radiocommunications equipment.

Several years earlier, at the World Administrative Radio Conference (1959), the ITU had adopted a recommendation on the use of radiotelegraph and radiotelephone links by Red Cross organizations. These were to be employed when normal communication facilities were disrupted, and they would use special radio frequency bands assigned by Member administrations as required.

These measures were successful, but only to a degree. They suffered from the fact that propagation phenomena precluded full effectiveness on a " round-the-clock " basis. They were limited by the need for essential relay facilities, lack of privacy and, unlike other systems, they were incapable of producing a written record (telex).

Therefore at the World Administrative Radio Conference for Space Telecommunications (WARC-ST, Geneva, July 1971), the ITU Member nations adopted a further recommendation on the use of *space radio communications systems* in the event of natural disasters and requested the Secretary-General of the ITU to

> " bring this recommendation to the attention of the United Nations, the specialized agencies and other international organizations concerned, in order to ensure their full co-operation in the implementation of this recommendation. "

The recommendation conveyed implicit recognition of the need for rapid, reliable telecommunication links in the event of natural disasters—famine, earthquakes, epidemics and similar emergencies—that telecommunications are essential for relief operation; and that the use of space radiocommunications systems is one of the means by which relief operations can be facilitated, particularly in areas where normal telecommunications are inadequate for relief operations.

The ITU also noted that the known planning (as at the time) of radiocommunication systems made

> " no provision for specific frequencies or channels for emergency communications;
>
> " that in the absence of such planning it is not feasible to proceed with specifications for rapidly transportable, universally operable earth stations; "

continuing, the recommendation urged that administrations

> " provide for the needs of eventual relief operations in planning their space radiocommunication systems and identify for this purpose preferred radiofrequency channels and facilities which could quickly be made available for relief operations; "

and that they

" waive the co-ordination procedures provided for in the Radio Regulations in the case of transportable earth stations used for relief operations. "

At the request of the United Nations and the WARC-ST, the ITU gave careful consideration to the question of the type of telecommunication equipment required immediately in the post-disaster period of a stricken area, and proposed a study to optimize the satellite potential for telecommunications.

With United Nations requirements in view, i.e. air-transportable earth stations easily packaged and transported by plane, road and small boats, the study would have to embrace such considerations as weight, size, ease of assembly, rapidity of installation, method of use, logistic support, maintenance possibilities and the number of equipments required.

Following immediate approval for the study by the Secretary-General of the ITU, the United Nations Development Programme (UNDP) allocated 50 000 US dollars towards defraying the costs entailed.

The study was in progress at the time of TELECOM 71, the first World Telecommunications Exhibition organized by the ITU. Manufacturers from all over the world had assembled in Geneva for the event and were anxious to give practical assistance. Amongst them were Mr. Lutz of Technology Resources, Mr. T. Sugahara of Nippon Electronics and Dr. M. Pahor of STS, whose contributions were particularly valuable.

The solution: satellites

Satellite communication, which can reach into places isolated by oceans, jungles, deserts and other natural hazards, was made feasible by the perfection of geosynchronous satellites. These satellites permit simple antennae with high gain to be utilized by earth terminals, thus reducing communication costs. At about 36 000 km above the equator, a satellite moving from west to east requires about 24 hours to complete one orbit of the earth. Since it coincides with our day, the satellite appears to be stationary. This geosynchronous orbit in which satellites are placed has now been in use for little more than ten years.

Justification for the ITU's proposal to harness the potential of satellite communications systems for disaster relief is clearly endorsed by studying the UN map No. 2022 (May 1971). This indicates the sites of the gravest natural disasters which occurred between 1961 and 1970 and for which an appeal was made to the League of Red Cross Societies. These sites represent population centres situated near the equator, particularly between longitudes 0° and 95° W and 0° and 130° E. The fact that the Pacific Ocean is bordered by industrialized countries (USSR, Japan, Australia, United States, Canada and Mexico) and that no request for assistance in this area was made in the past ten years means that one-third of the earth's surface is capable of dealing from local resources with any emergencies that may arise.

On the ITU chart (figures 1 a), b) and c)) showing earth stations for the public telecommunication services, the shaded area represents the part of the earth's surface which can be seen from a satellite placed in geosynchronous orbit, or which can be covered by the antennae of a geostationary satellite placed over the equator at the longitude indicated by the white point (in the centre of the shaded

area). In figure 1 a) the area extends as far as 95° W longitude and includes the West Indies, Latin America, Africa, Europe and the Middle East. The satellite is placed over the equator at about 18° W longitude.

If another satellite is placed so that the area extends to 130° E longitude (figure 1 b)) it will cover the Far East, Africa (except for the western extremity), Europe and the Middle East. The satellite is situated over the equator at about 55° E longitude.

It will be noted from figure 1 c) that areas 1 and 2 overlap. The extent of the overlap can be changed by varying the position of the two satellites over the equator.

Therefore it was assumed that a geostationary telecommunication satellite placed over the equator between 15° and 35° W longitude and another between 55° and 75° E longitude would be enough. These are the normal sites of the International Telecommunications Satellite Organization (INTELSAT) satellites above the Atlantic and Indian Oceans.

Which satellite?

The study, completed by 1973, containing the specifications for equipment tailored to UN requirements, focused the attention of private manufacturers on the need for earth terminals, light enough to be transported by air, with the result that several companies now produce similar equipment.

But the question of which satellite could be used as the link between the transportable earth terminals in disaster zones and relief centres remained unanswered.

It was true that satellite communications were in operation, but only at commercial rates—too expensive for the tests and experiments that would be needed to demonstrate that the concepts of the ITU and its collaborators were viable and efficient.

However, in 1974, the Franco-German *Symphonie* satellite programme was activated with the launching of its first satellite into synchronous orbit—the specific objective being experimental transmissions designed to further satellite communications technology.

This was a fortuitous development, and the ITU requested the Symphonie project to make available facilities for a practical demonstration of the air-transportable earth station by October 1975.

From the outset of the request, Symphonie offered the most generous help and co-operation. In sum it amounted to the provision of satellite time, earth station facilities and the air-transportable earth station equipment which will be demonstrated in action at TELECOM 75 (Geneva, 2-8 October 1975).

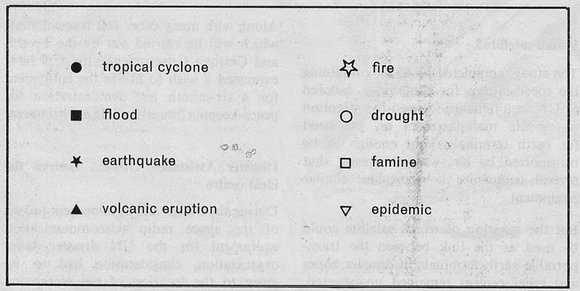
Along with many other test transmissions which will be carried out by the French and German Governments, the UN have expressed a wish to utilize the equipment for a six-month test demonstration for peace-keeping forces in a field environment.

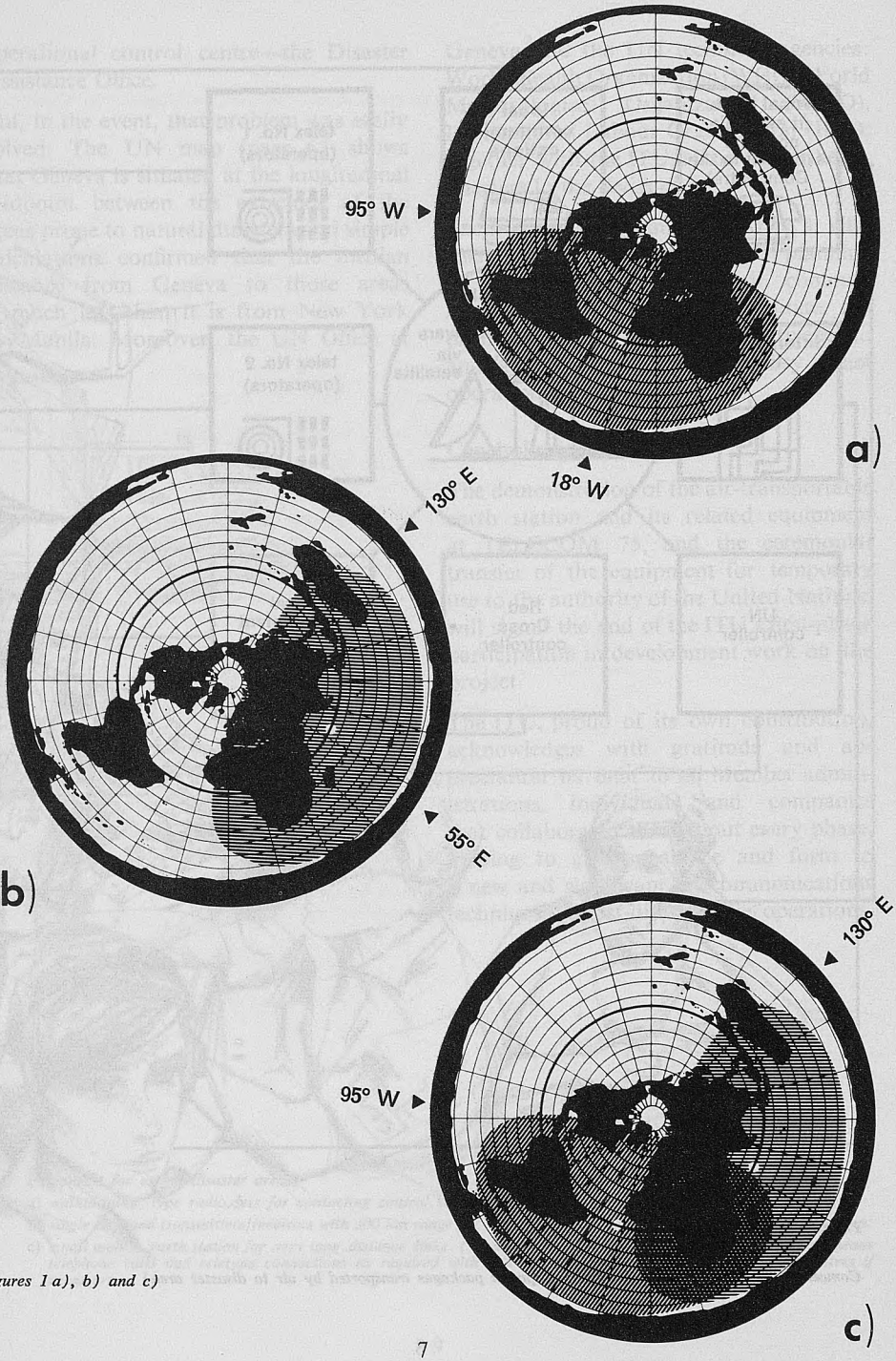
Disaster Assistance Office... Geneva the ideal centre

During the design and development phases of the space radio telecommunication equipment for the UN disaster relief organization, consideration had to be given to the location of the emergency

Natural disasters occasioning a major appeal on the part of the League of Red Cross Societies during the period 1961-1970

(United Nations - Map No. 2022, May 1971)





Figures 1 a), b) and c)

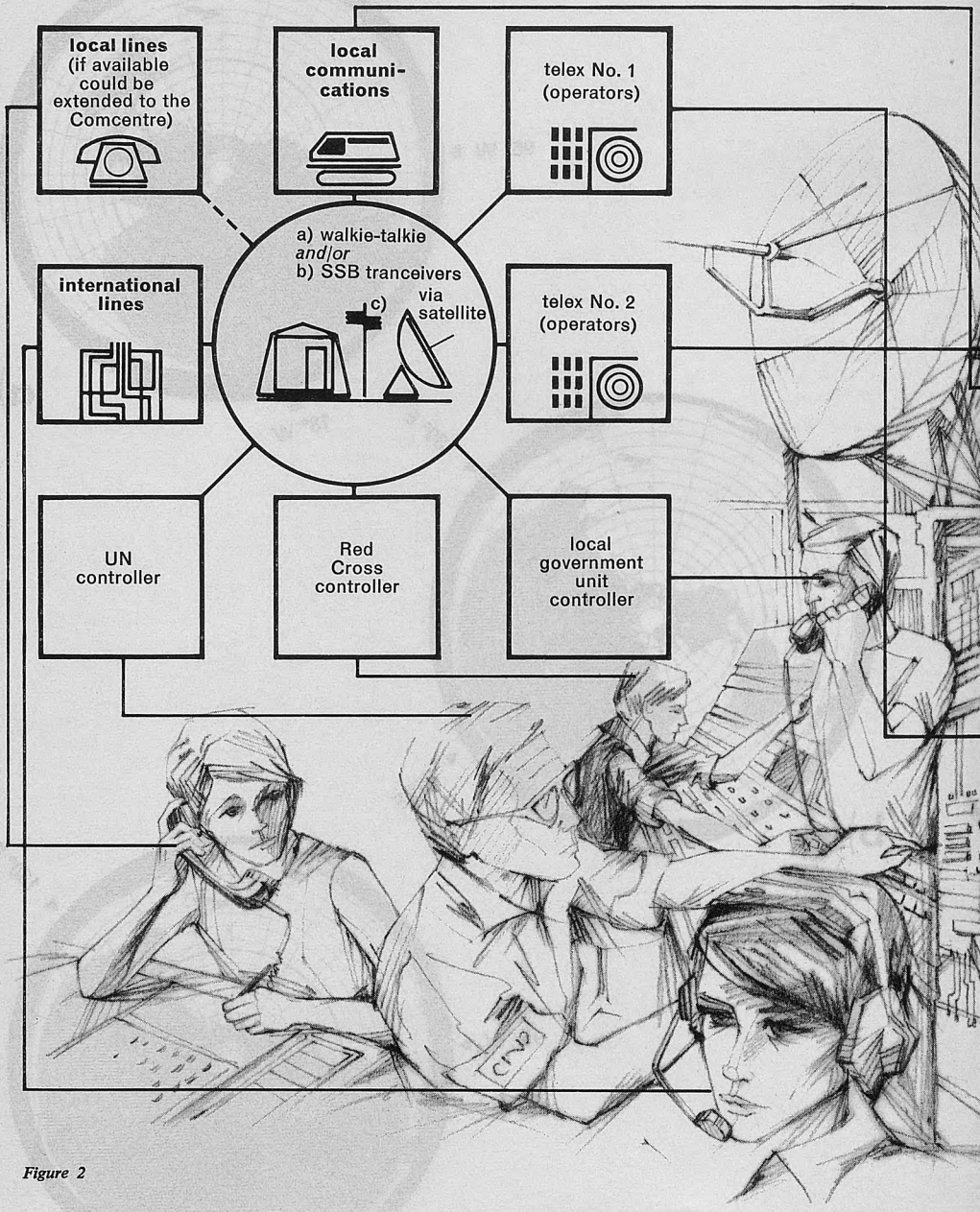


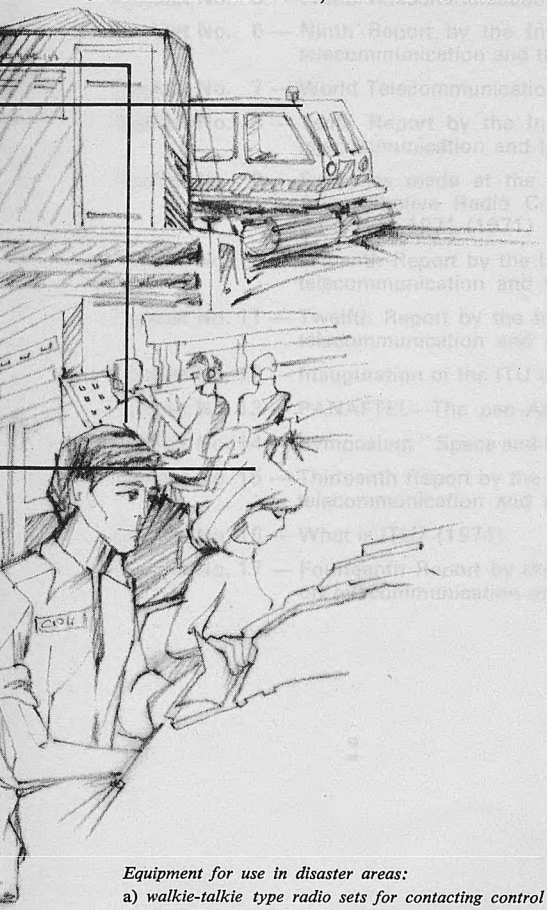
Figure 2

Comcentre — Communications centre (equipment packages transported by air to disaster area)

operational control centre—the Disaster Assistance Office.

But, in the event, that problem was easily solved. The UN map (page 6) shows that Geneva is situated at the longitudinal midpoint between the extremes of the areas prone to natural disasters and simple calculations confirmed that the median distance from Geneva to those areas is much less than it is from New York or Manila. Moreover, the UN Office at Geneva and the UN technical agencies: World Health Organization (WHO), World Meteorological Organization (WMO), International Labour Organisation (ILO), together with the ITU, all have their headquarters in the Swiss city.

Each of those organizations has a vital role to play within the UN's planning for disaster relief and their common location in Geneva will facilitate co-ordination, speed of action, effectiveness... and reduce costs in emergency relief operations.



Conclusions

The demonstration of the air-transportable earth station and its related equipment at TELECOM 75, and the ceremonial transfer of the equipment for temporary use to the authority of the United Nations, will signal the end of the ITU's first-phase participation in development work on the project.

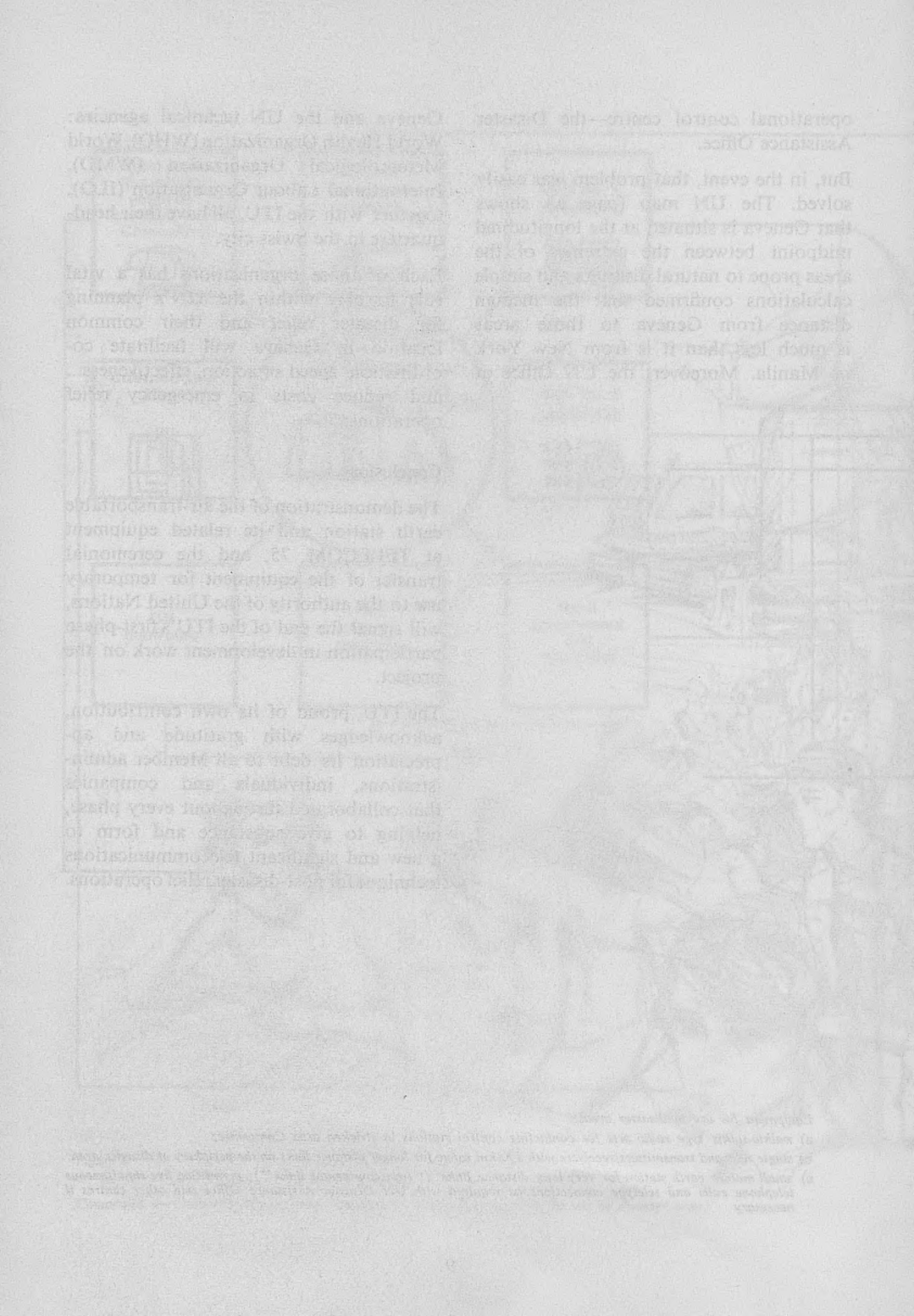
The ITU, proud of its own contribution, acknowledges with gratitude and appreciation its debt to all Member administrations, individuals and companies that collaborated throughout every phase, helping to give substance and form to a new and significant telecommunications technique for post-disaster relief operations.

Equipment for use in disaster areas:

a) *walkie-talkie type radio sets for contacting control stations in stricken area Comcentre;*

b) *single sideband transmitters/receivers with 300 km range for longer distance links on the periphery of disaster area;*

c) *small mobile earth station for very long distance links ("transcontinental links"), permitting five simultaneous telephone calls and teletype connections as required with UN Disaster Assistance Office and other centres if necessary*



Other information publications on the ITU:

Book — From semaphore to satellite, 1793-1965 (1965)

Booklet No. 1 — 1865-1965, a hundred years of international co-operation (1967)

Booklet No. 2 — ITU and space radiocommunication (1968)

Booklet No. 3 — Eighth Report by the International Telecommunication Union on telecommunication and the peaceful uses of outer space (1969)

Booklet No. 4 — Symposium " Space and Radiocommunication ", Paris, 1969 (1969)

Booklet No. 5 — World Telecommunication Day—17 May 1969 (1969)

Booklet No. 6 — Ninth Report by the International Telecommunication Union on telecommunication and the peaceful uses of outer space (1970)

Booklet No. 7 — World Telecommunication Day—17 May 1970 (1971)

Booklet No. 8 — Tenth Report by the International Telecommunication Union on telecommunication and the peaceful uses of outer space (1971)

Booklet No. 9 — Speeches made at the inaugural meeting of the second World Administrative Radio Conference for Space Telecommunications on 7 June 1971 (1971)

Booklet No. 10 — Eleventh Report by the International Telecommunication Union on telecommunication and the peaceful uses of outer space (1972)

Booklet No. 11 — Twelfth Report by the International Telecommunication Union on telecommunication and the peaceful uses of outer space (1973)

Booklet No. 12 — Inauguration of the ITU tower (1973)

Booklet No. 13 — PANAFTEL—The pan-African telecommunication network (1974)

Booklet No. 14 — Symposium " Space and Radiocommunication ", Paris, 1973 (1974)

Booklet No. 15 — Thirteenth Report by the International Telecommunication Union on telecommunication and the peaceful uses of outer space (1974)

Booklet No. 16 — What is ITU? (1974)

Booklet No. 17 — Fourteenth Report by the International Telecommunication Union on telecommunication and the peaceful uses of outer space (1975)

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