Title: **Gateway to Science and Development: an innovative integrated approach to the enhancement of science in developing countries with applications to disaster prevention and evaluation of natural resources**

Acronym: GS&D

Date: 07 March 2004

Instrument: **Specific Support Action**

Participants:

1 - International Centre for Theoretical Physics (ICTP), Trieste, Italy

2 – Aidworld Humanitarian ICT, Cambridge, UK

3 - Comisión Nacional de Actividades Espaciales (CONAE), Buenos Aires, Argentina

4 – Usikov Institute for Radiophysics & Electronics (IRE), National Academy of Sciences, Kharkov, Ukraine

5 – Stanford Linear Accelerator Center (SLAC), Menlo Park, CA, U.S.A.

6 - Space Technology Application Center (STAC) of the Institute of Physics of the National Centre for Natural Science and Technology, Hanoi, Vietnam

7 - University Library of the Vrije Universiteit Brussel (VUB), Belgium

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SUMMARY

Title: *GS&D*: Gateway to Science and Development: an innovative integrated approach to the enhancement of science in developing countries, with applications to disaster prevention and recovery

Acronym: *GS&D*

Strategic Objectives:

To elaborate methods and means to narrow the gap between developed and developing nations by bridging the digital divide using e-mail to web techniques and affordable hardware to mount sustainable information networks to enable scientists from developing countries to access online literature and Internet information sources. To validate these technologies, applying them to the exchange of data to generate and process microwave and optical images of the Earth to forecast environmental disasters and evolution of natural resources.

Abstract:

New technologies have usually been considered as a mean to advance the global society. However, today's technologies such as the World Wide Web have, on the other hand produced a gap in the newly arrived Information Society, between those who have and those who have not, called the *digital divide*. In the last few years, many organizations, societies and individuals have made efforts to bridge this gap. A pioneering program to reach individual scientists in regions with slow connectivity, as well as very poor institutions, using e-mail to Internet techniques to provide them with single articles of the available online scientific literature was designed by the ICTP, and launched in 2002. Here we propose to build on this program a more comprehensive initiative to bridge the digital divide on a larger scale and to facilitate fast connectivity to the society as a whole in developing countries. ***This proposal attempts to help bridge the digital divide among scientists in different countries and applies these same techniques for adequate and last mile connectivity to the benefit of society as a whole. The project consists of Monitoring Internet by PingER, to provide knowledge on the geographical distribution of connectivity especially to and within developing regions, building pilot projects to provide wireless transmission in Cameroon (University of Douala) and Ukraine (IRE-NASU), providing training into all the steps to build and keep the connection going, including developing and deploying hardware, software and virtual laboratories. Finally, one specific item we will explore in some detail is the use of remote sensing tools together with the use of fast data sharing via Internet for the prevention and recovery from environmental disasters as well as the evaluation of natural resources.***

B.1 Objectives of *GS&D:*

GS&D proposes approaches to: provide dramatically improved Internet performance utilizing wireless technologies; extend improved delivery of scientific literature to developing nations; provide measurements to identify and suggest solutions for problems of Internet performance to and within developing regions; and show an application of the use of remote sensing tools together with the use of fast data sharing via the Internet, for the prevention and recovery from environmental disasters as well as the evaluation of natural resources. This project represents a collaboration between scientists and teachers from institutions in Argentina, Belgium, Italy, Vietnam, UK, Ukraine and USA.

The main objectives can be summarized as:

● To elaborate methods and tools to **disseminate and transfer scientific knowledge** being appropriate and efficient for developing countries

● To **develop pilot projects** which show cost effective ways to build and monitor the infrastructure for advanced wireless information networks.

● To develop **capability building in ICT targeted to scientists,** to guarantee the success of the pilot projects through the formation of members of the local and regional institutions to continue the work.

● To develop methods to **create acceptable and sustainable Internet accesses** for scientists, including those for monitoring to provide planning, expectation, troubleshooting and information for policy making.

● **To validate the use of the new information technologies** developed in the project for fast transmission of large volumes of information through slow networks in developing countries to the exchange of massive data to generate and process Synthetic Aperture Radar and optical images applied to forecast environmental disasters and evolution of natural resources.

B.2 Relevance of the *GS&D* Project

New technologies have usually been considered as a means to advance the global society. However, today's technologies such as the World Wide Web have, on the other hand produced a gap in the newly arrived Information Society, between those who have and those who have not. This is often referred to as the *digital divide*. In the last few years, many organizations, societies and individuals have made efforts to bridge this gap. In November 2001, the International Centre for Theoretical Physics at Trieste (ICTP) launched the electronic Journals Delivery Service (eJDS) to serve Physics, Mathematics and interdisciplinary subjects. The eJDS was designed to reach individual scientists in regions with slow connectivity, as well as very poor institutions, using e-mail to Internet techniques. Two years have passed since this pioneering program was launched; it is now time to think of a more comprehensive initiative to bridge the digital divide on a larger scale and to facilitate fast connectivity to the society as a whole in developing countries.
This is the context of this proposal, which at one and the same time attempts to help bridge the digital divide among scientists in different countries and applies these same techniques for adequate and last mile connectivity to the benefit of society as a whole. One specific item we explore in some detail is the use of remote sensing tools together with the use of fast data sharing via Internet for the prevention and recovery from environmental disasters as well as the evaluation of natural resources. The expertise in these areas, provided by Argentina, Ukraine and Vietnam will fulfill one of the objectives of the Sixth Framework Programme: "to help European researchers … to have access to knowledge and expertise existing elsewhere in the world", while at the same time European researchers will contribute to the solution of specific problems faced by developing countries through equitable partnerships.

The ICTP in Trieste has been at the forefront of the effort to provide alternative ways to Internet connectivity, and intends to take a leading role in enabling the transfer of knowledge and data exchange. The partners in this project already possess the infrastructure and experience that will be leveraged to enable the goals of this project to be reached in a minimum amount of time. Building on existing infrastructures and experience will also help ensure sustainability for the future and enhancement of existing efforts for the transfer of knowledge.

The present approach attempts to: evaluate and deploy the necessary infrastructure to provide and demonstrate faster access to Internet for selected sites/collaborations that currently have poor connectivity; the actual delivery of scientific literature to most regions of the developing world; monitoring of Internet performance to and within developing regions; and finally showing its application in the prevention and recovery from environmental disasters. This project represents the collaboration between scientists and teachers of a network formed by institutions from Belgium, Italy, Argentina, Vietnam, Ukraine, UK and USA.

The project here presented was motivated by The Declaration of Principles of the World Summit on the Information Society (WSIS), which states:

> A well-developed information and communication network infrastructure and applications, adapted to regional, national and local conditions, easily-accessible and affordable, and making greater use of broadband and other innovative technologies where possible, can accelerate the social and economic progress of countries, and the well-being of all individuals, communities and peoples.

It is also motivated by the Plan of Action of WSIS which accepts that the:

Information and communication infrastructure [is] an essential foundation for the Information Society

and proposes to:

> -Encourage the use of unused wireless capacity, including satellite, in developed countries and in particular in developing countries, to provide access in remote areas, especially in developing countries and countries with economies in transition, and to improve low-cost connectivity in developing countries.

-Optimize connectivity among major information networks by encouraging the creation and development of regional ICT backbones and Internet exchange points, to reduce interconnection costs and broaden network access.

- Develop and strengthen national, regional and international broadband network infrastructure, including delivery by satellite and other systems, to help in providing the capacity to match the needs of countries and their citizens and for the delivery of new ICT-based services. …

- Explore other systems that can provide high-speed connectivity.

At the recent conference on the Role of Science in the Information Society, a satellite conference to the World Summit on the Information Society held recently in Geneva, it was recognized that "*scientists have a particular moral responsibility to prevent the "digital divide" from further increasing the gap between rich and poor*", and that "***the information society offers scientists from all parts of the world the opportunity to contribute to the global scientific adventure*** *of which CERN's Large Hadron Collider is just one example*". **This project follows the steps of CERN by amalgamating the solution of scientific literature, fast Internet connectivity, monitoring and prevention and recovery from environmental disasters as well as evaluation of natural resources through remote sensing.**

B.3 Potential Impact

The project *GS&D*

The benefits of today's communications and information technologies are still far from being available to all. Scientific competitiveness and presence in a globalized world, especially from remote areas, requires reliable access to the Internet at low costs as well as tailored services. In parallel, the possibility of carrying out real-time network monitoring has the potential to quantify and better understand this digital divide.

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The use of the Internet as a channel for the dissemination of science is paramount, and it is impossible to overstate the importance of the access of scientific data and information to the scientific community. This is necessary for the advancement of research and education in order to provide content that contributes to the benefit and well-being of all societies and to promote international scientific and technological cooperation in areas of social importance such as the prevention and recovery of environmental disasters as well as the evolution of natural resources, which are needed to be preserved.

Scientists working in remote areas, having low-bandwidth access to the Internet, require special support. Without such support, this precarious situation will continue to have detrimental effects on all. It is necessary to ensure that the most up-to-date science arrives there, **this being one of the objectives of this project.** The project attempts to provide all the needed steps: content, access, infrastructure, training, network monitoring, data sharing between countries to assist in the prevention and solution of environmental disasters and evolution of resources and transfer of knowledge to and from developing countries.

It is expected that this project, ***GS&D***, will help to reduce scientific isolation while filling the need to transfer knowledge in an unprecedented way to and from countries in less developed geographical areas. It also aims to help to sustain further development in the South.

At present the main problems for countries of low income economies to access scientific information through Internet are:

1. The high price of the scientific literature.
2. Insufficient bandwidth/speed of communication via Internet.
3. Insufficient funds to pay for the actual connection.

To allow developing countries scientists to access scientific knowledge as well as transfer data via Internet to their peers with the speed that modern society requires, ***GS&D*** will attempt to bridge the digital divide gap extending the available infrastructures via wireless networks. This will start with a pilot project in Cameroon, while training the local scientists and technicians to build and develop the systems. The ICTP, in collaboration with SLAC (Stanford University), through the PingeR Project (see Workplan) will monitor the connectivity to and between these sites, providing a quantitative measure of the success of ***GS&D***. It is clear that the final success will depend on the advance of science and technology, through access to the most up-to-date literature.

Access to current literature will be accomplished immediately through the eJournals Delivery Service (eJDS,) which has been operating at ICTP with the use of an open source code, called *www4mail,* developed locally. This software allows the user to follow hyperlinks as well as download Web pages, using only electronic mail, as if they were surfing the Web via a live Internet connection. At present, the system is being adapted to meet the needs of a dynamical Web environment where the contents to be circulated require special attention to the low-bandwidth (and unreliable) networks. Therefore, it meets the requirements that are necessary to overcome the problems defined above. **The results from the hosts being monitored will reveal the effective computer network realities with which scientists in the third world work on a daily basis**.(CERNCourier, 43, 16 (2003))

As mentioned in part B.2, the information society offers scientists from all parts of the world the opportunity to contribute to the global scientific adventure. This project in particular merges several aspects of the divide between developed and developing countries: infrastructure and Internet monitoring towards understanding and diminishing the digital divide; actual delivery of scientific literature for scientists in developing nations; and an application of socio-scientific character **to mitigate environmental disasters through the fusion of data acquired by monitoring the local Internet and data obtained using Remote Sensing Technology. Remote Sensing Technology** widely uses space-borne Synthetic Aperture Radars (SAR) therefore it provides a powerful tool for detection, evaluation and solving of environmental, social and economic problems in accordance with the availability of scientific developments. Governments understand the strategic value of remote sensing, for the planning and administration of the resources related with the economic and social development, taking into account the ability to cover great territorial extensions by space observation, in short periods of time and at lower costs than by means of terrestrial or airplane surveys. Remotely sensed information of the Earth surface plays a crucial role in the prevention, evaluation and decision making in the mitigation of the effects of environmental disasters, as the information becomes rapidly available, at times compatible with emergency case needs. Though information acquired via some space borne SARs is commonly available it is still not in use in many developing countries because of lack of adequate means for its reception, storing and processing. For the prevention of probable environmental disasters the improved rapid and efficient distribution of remotely sensed information, such as that provided by the satellites of CONAE, is even more important. This is usually a problem today in many developing countries. The integrated impact of the current project will facilitate a proper functioning of the system when working in the solution of a newly happened environmental disaster, in particular to enable the efficient working of international collaborations to address the disaster.

This project, aimed at solving some problems in developing countries, strengthens the relation between centers of excellence in scientific and technological aspects in Europe, South and North America, Asia and Africa, which join their efforts to solve some of the most serious problems in today's society and to achieve the UN Development Millenium Goals.

B.4 The Consortium and Project Resources

ICTP is the project coordinator. The ICTP in Trieste has a world-wide reputation for its significant contributions to the internationalization of science since 1964, and today its mandate has become even more relevant. The ICTP has the resources, via the S&T Collaborium initiative, to provide the needed capacity building to create a critical mass of skilled people in ICT by training on Communication, Wireless Networking, Web enabling Technologies and the adaptation of technology to local needs. ICTP can devote resources to help monitoring in real time the connectivity of research and educational institutions in developing countries and to encourage (and devote resources to) the development of the connectivity. The ICTP, through the eJDS, will continue to provide low cost or free access to scholarly literature for and by developing countries where reasonable Internet bandwidth is available and for developing countries where publisher's revenue is not significantly impacted. Much of the future for the gateway to science and development relies on the access that scientific institutions and universities have to the Internet. Finally ICTP has the infrastructure to organize training courses at low cost.

Aidworld has demonstrated unique expertise in the development of low bandwidth management software applications and service. Team members include experienced aid workers and a technical team with first-rate commercial and academic credentials. Some of their proto-type work can be seen at www.aidworld.org including tools and services designed for use in the South and assessment tools for establishing the effectiveness of existing facilities available on the Internet. The team have direct access to the Computer Science Department, of the University of Cambridge and to The Judge Institute of Management. The Department for International Development (UK Government) have requested that Aidworld assist their proposed Bandwidth Management programme, commencing in 2004, looking at issues of accessibility in the South. Some of their proto-type work can be seen at www.aidworld.org including tools and services designed for use in the South and assessment tools for establishing the effectiveness of existing facilities available on the Internet.

CONAE, SAOCOM SAOCOM 1-A MISSION, developed by CONAE (www.conae.gov.ar), is the first of a new generation of satellites to sensor the Earth, which work in the microwave range, with active sensors (radars). SAOCOM 1-A instruments will have a spatial resolution of 10 meters and will penetrate down to 2 meters in depth, thus providing information on soil humidity as well as geological structure. It can work under any meteorological condition, at any time of day and or night, and it is not affected by the presence of clouds, fog or rain, as the optical cameras are. The infrared camera, on the other hand can detect fires as well as volcanic activity. This is an excellent satellite to work in the detection of emergencies and the monitoring of natural resources. Very recently, CONAE and the Italian Space Agency (ASI) have formed the SIASGE System (Italian Argentinean System of Satellites for Emergency Management) formed by two satellites SAOCOM, provided by CONAE and four satellites provided by the ASI of the type COSMO-SKYMED. This makes SIASGE a unique Polarimetric Double-Band (X+L) SAR Mission, which will provide the most adequate information for emergency management. The six satellites will be placed on polar orbits at the same height, on different orbital planes, such that the set will act as an instrument with a wide range of vision over the Earth. This will provide information on almost real time, since the updating will be every 12 hours, thus being able to follow the evolution of catastrophes of different kinds.

IRE NASU - The Usikov Institute of Radio Physics and Electronics of the National Academy of Sciences of Ukraine determines the level of the national science in radio-physics and electronics, i.e. in generation, propagation and transmit-receive of radio-waves with applications in various areas, such as radar, telecommunications, remote sensing, etc. The Scientific Council of NASU on "Radio-Physics and Microwave Electronics" is responsible for elaborating the national policy in the broad area of microwave and MM-wave physics and technology. IRE NASU has pioneered design of some devices and technologies in microwave and millimeter wave electronics and electromagnetic. It has great R&D experience in many areas, such as radar, radio oceanography, remote sensing, microwave telecommunications, and others. For example, space-borne X-band side-looking and synthetic aperture radars have been developed in IRE NASU and used for pioneering observations of Earth from space platforms (famous satellites "Kosmos-1500" and "Kosmos-1602"). Besides, IRE's staff has experience in design, development and exploitation of microwave and MM

wave telecommunication systems to create local information networks within the concept of Local Multipoint Distribution Service (LMDS). The system of that type, MITRIS, was designed and tested in cooperation with industry is a broadband wireless point-to-multipoint communication system operating at 10GHz, 36GHz or 41GHz. It may be constructed in a point-to-point or point-to-multipoint fashion, providing digital data, Internet, and video services in areas with no infrastructure. The IRE NASU staff's expertise is very much suitable for demonstration of potential capabilities of microwave LMDS tools, such as MITRIS, for construction of technically efficient and cost effective information network in developing countries

SLAC, SLAC and ICTP have signed a Memorandum of Understanding in order to measure Internet traffic by PingER from developing countries. These measurements and analyses provide a better quantitative understanding of the Digital Divide. Some of the initial results have already been published, and show some interesting and somewhat alarming results (CERNCourier, 43, 16 (2003), enclosed). Consideration of these results will enable a better distribution of funding resources for computer networking and accessibility to the Internet from remote areas in the South and in turn will lead to improved sharing of scientific contents. The PingER project was initially developed in 1995 to meet the needs of large High Energy and Nuclear Physics (HENP) collaborations, and over the years has been extended to other scientific communities, mainly in the developed world. This project proposal will further extend the measurements to and within developing countries and regions, and provide new analyses and reports of the data particularly related to developing countries and the Digital Divide. In particular it **will address the challenge of obtaining real-time data from scientific hosts in most African Countries.** Monitoring of Africa Networking will lead to quantifying the Digital Divide realities in the region, and help to create awareness of the real lack or paucity of connectivity, and networking performance. Special attention will be focused on the needs of low-bandwidth (and unreliable) networks, in particular to minimize the monitoring traffic impact, and to develop tools to audit the links to spot and report long periods of loss of connectivity. Monitoring Web behavior in developing countries will help in programs of social importance, such as prevention and control of environmental disasters.

STAC. The main activities of the Space Technology Application Centre (STAC), Institute of Physics & Electronics (VIPE), Vietnamese Academy of Science & Technology (VAST), Vietnam are to promote the use of remote sensing for effective monitoring of natural resources and protection of environment from disasters. Vietnam, a developing country, prone to have natural disasters due to its location, needs an effective way to reduce the long term social and economic impacts of those disasters. They can be forecasted using remote sensing technologies, especially the use of optical & SAR image processing, and limit their damage. STAC has already developed a variety of techniques and methodology, to analyze different types of remotely sensed data, in order to use them in definite applications such as flood, drought monitoring, desertification and forest fires. Some projects already carried out by STAC are: use of SPOT and TM images for land-use mapping at the scale of 1:250,000 and 1:100,000 for the whole country; use of RADARSAT (*of Canada*) and ERS (*of European Space Agency - ESA*) SAR images for flood monitoring in Mekong Delta *(in South Vietnam)*; application of radar images for land-use, land cover mapping in the Mekong Delta; use of MODIS data to determine some physical parameters of the surface of the sea.

VUB, The personnel of the University Library of Vrije Universiteit Brussel (VUB), Belgium has built up experience during more than 20 years with applications of information and communication technology in providing access to scientific information. This is reflected nowadays by concrete products and actions:The computer-based library management software named VUBIS has been developed locally and is continuously refined and extended. It is distributed by the international company GEAC in Belgium and The Netherlands, where it is now the market leader. Recently GEAC abandoned their other library software packages to focus on distribution and support of VUBIS exclusively, on an international scale. The most recent addition to VUBIS is V-link, an OpenURL resolving software system to assist users in finding appropriate information that is related to an information item that is already known; an example here is direct access to the most appropriate copy of the full text article that is described in a known bibliographic reference. In view of the expertise built up over the years, the University Library has been (and is) involved in numerous and various international training and consultancy projects. Project currently running are in: Tanzania and Kenya. http:///.vlir.be/

GS&D proposes approaches to: provide dramatically improved Internet performance utilizing wireless technologies; extend improved delivery of scientific literature to developing nations; provide measurements to identify and suggest solutions for problems of Internet performance to and within developing regions; and show an application of the use of remote sensing tools together with the use of fast data sharing via the Internet, for the prevention and recovery from environmental disasters as well as the evaluation of natural resources. These objectives can be achieved making use of the way partners in the project complement each other.

The particular role played by each partner at each step of the project is described in B.6. Here we simply make a summary of links and collaborations:

● eJDS of ICTP, and SLAC complement each other to monitor Internet performance in developing countries.
● eJDS and S&TCollaborium of ICTP will collaborate with VUB in the execution of Virtual Laboratories and training, for an effective use of ICT in developing countries, with a far reaching view of developing digital libraries.
● AidWorld, ICTP and VUB will collaborate in the development of Open Sources Software for an effective use of low-bandwidth Internet.
● eJDS of ICTP and STAC will collaborate in extending the accessibility to more Publishing Houses.
● IRE NASU and ICTP-ARPL will collaborate in the development and installation of wireless technologies.
● STAC and CONAE will collaborate in the provision and processing of SAR data to apply to prevention, control, evolution of environmental events. ICTP and SLAC will participate in the provision of fast connectivity.

	Salaries	Consultants	Field Costs	Travel	Equipment. Books,etc	Training	Services	Management Overhead, Indirect Costs	Total In Euro
ICTP	120000	15000	20000	30000	50000	70000	20000	65000	390000
AidWorld	150000	10000	5000	12000	5000			28000	210000
CONAE	160000			25000	10000	50000			245000
IRE NASU	70000		20000	20000	100000	40000	40000	44000	334000
SLAC	100000			7000			35000	40000	182000
STAC	30000	15000		25000	20000	40000	30000		160000
VUB	90000	15000		10000	10000		20000	22000	167000
TOTAL									**1688000**

B.5 Project Management

The participants:

ICTP, International Centre for Theoretical Physic, Trieste, Italy. Founded in 1964 by Abdus Salam (Nobel Laureate), ICTP is widely known for its mission is to foster the enhancement of sciences in developing countries, by means of programs of training, conferences, research and international collaboration, which has been doing quite effectively since its foundation. (http://www.ictp.trieste.it)
The sections that will collaborate in this project are: Donation Programme through the eJournals Delivery Service (eJDS, http://www.ejds.org), providing access to Scientific Journals, via e-mail and Web/e-mail gateways; the Aeronomy and Radio Propagation Laboratory (ARPL), providing wireless technology, S&T Collaborium Initiative (ICTP spin off), providing training courses, the ICTP Library and ICTP Scientific Computer Section providing the necessary expertise.

Aidworld Humanitarian ICT, Cambridge, United Kingdom Aidworld is a not-for-profit organisation working with UN/OCHA, UNDP, IFRFC, BRCS, MIT, DFID, Oneworld, Bellanet and the Open Knowledge Network. The organisation is associated with the University of Cambridge, a recognised centre of excellence in the field of new ICT projects, for funded research projects. The team has direct access to the Computer Science Department, are members of the Crucible Interdisciplinary research group and include experienced aid workers. Aidworld can also draw upon expertise within The Judge Institute of Management Studies, where research into ICTs for development is particularly strong. Researchers at The Judge will enable Aidworld to carry out detailed assessment and analysis of their work

COMISION NACIONAL DE ACTIVIDADES ESPACIALES (CONAE), Buenos Aires, Argentina: CONAE is the only Argentinean governmental agency, created to understand, design, control, manage and administer projects, activities and enterprises in spatial matters in Argentina. Its mission is to propose and execute the National Spatial Plan: Argentina en el Espacio, 1995-2006, recently extended to 2008 (to be approved).
Gulich Institute, belonging to CONAE is placed at the Teofilo Tabanera Station (Cordoba, Argentina). The main objectives of the Institute are: a) to generate advanced knowledge and applications in remote sensing technologies b) to train human resources in the field c) to give support to the Space Information Cycles.

IRE NASU - The Usikov Institute of Radio Physics and Electronics of National Academy of Sciences of Ukraine (IRE NASU), Kharkov, Ukraine was established in 1955. Today it has about 600 employees, including 220 scientists. The main task of the Institute is research and developments in a wide frequency range of the electromagnetic wave spectrum, with special emphasis on the millimeter (MM) and sub-millimeter (sub-MM) waves. IRE NASU is a widely-known scientific center, that determines the level of the national science in radio physics, vacuum electronics, radar, remote sensing, and telecommunications. Along with basic research the various R&D activities in radio wave propagation and remote sensing of Earth from airborne and space-borne platforms are carried out in IRE NASU. In particular, a new field of remote sensing - the Radio Oceanography - has been initiated in IRE NASU, which concerns with radar measuring of characteristics of sea waving, as well as with pioneering observations of Earth from space platforms such as the first Soviet space-borne X-band side-looking radar (famous satellites “Kosmos-1500” and “Kosmos-1602”). Recently, a new radar technology, Noise Radar Technology (NRT), has been elaborated in IRE NASU which inspired RTO NATO to start (2003) a new Exploratory Team on NRT based on the results obtained.

SLAC, the Stanford Linear Accelerator Center, Menlo Park, CA, U.S.A. is a national laboratory that is both a School and a Department of Stanford University. SLAC’s research is funded by the Department of Energy of Science. SLAC is one of the world’s leading research laboratories. Established in 1962, it is located at Stanford University. The mission is to design, construct and operate state-of-the-art electron accelerators and related experimental facilities for use in high energy physics and synchrotron radiation research. SLAC is recognized internationally with 3000 visiting scientists from US universities, national laboratories, industrial concerns and foreign countries. With the large number and sizes of scientific collaborations, high quality communications and networking is critical. SLAC therefore embraced the Web at its earliest days and SLAC

is home of the first U.S. Web site. Also to enable good communications with scientists in developing countries SLAC fostered the development of the Internet End-to-End Monitoring project and PingER.

***STAC*, the Institute of Physics of the National Centre for Natural Science and Technology, Hanoi, Vietnam.** The Institute of Physics (IOP) belongs to the National Centre for Natural Science and Technology of Vietnam (NCST of Vietnam) – the largest organization for scientific research and technology of Vietnam. NCST of Vietnam is composed of many sections including: The Institute of Mathematics, the Inst. of Biological Technology, the Inst. of Geography, the Inst. of Chemistry, the Institute of Physics. See http://www.ncst.ac.vn/ The relevant departments of the Institute of Physics to this project are: Center for Theoretical Physics, Center for Nuclear Physics, Center for Quantum and Photonics, Department of Automation, Space Technology Application Center (STAC) etc. See http://www.iop.ncst.ac.vn/ . The Project partner is the Space Technology Application Center (STAC) that studies Remote sensing Technology and Applications. STAC is composed of: the Department of Remote sensing Technology and the Department of Remote Sensing Application.

University Library of the Vrije Universiteit Brussel (VUB), Belgium
The VUB University belongs to the Flemish part of Belgium and has a very international character. See http://www.vub.ac.be/ . The VUB University Library is a hybrid library that provides access to classical printed sources and that offers access as fast and as much as possible to digital information sources. The WWW site is http://www.vub.ac.be/BIBLIO/

Leadership and Management:

The project will be managed from the coordinator's organization: the International Centre for Theoretical Physics, where already exists the necessary infrastructure.

Decisions will be made after consultation with partners, and by consensus, whenever possible. In case this cannot be achieved, the final decision will be taken by the coordinator of the project.

Results of the measurements, project updates, related news, ongoing research, statistics, seminars given, publications, project reports, etc will be made available through the eJDS Web Portal at www.ejds.org. to all partners, Management of data, code design and development will be done at the different institutions collaborating in the project.

The issue of intellectual property rights is of great relevance to this project since one of its goals is the availability of scientific publications to single scientists in developing countries. Publishing houses and ICTP have agreed on warning the qualified users of the service that:
All eJournals are protected by copyright. These are provided under the eJDS service for the Qualified User´s personal use only and may not be re-distributed, re-purposed, altered, adapted, recompiled, systematically copied, sold, posted on any website or used for any commercial purposes without the respective Publishers´ prior written consent.

Exchange of documents and databases of scientific content fall within fair use of Intellectual Property Rights legislation.

Use of Open Sources Software will be made, whenever possible.

B.6 Workplan of the *GS&D* Project

This Workplan is organized according to the objectives defined in part B.1. The partners responsible for each task are indicated in each of them.

a) To elaborate methods and tools to disseminate and transfer scientific knowledge being appropriate and efficient in developing countries:

*1) Access to Scientific Knowledge (*ICTP,STAC*)*
Transfer of knowledge: To provide access to the most recognized scientific journals to scientists in developing countries. We shall use the eJournals Delivery Service (eJDS), which in January 2002 started providing access to all on-line Journals of the Academic Press, American Physical Society and World Scientific. At present, the system guarantees access to the most cited houses in Physics: American Physical Society, Elsevier, Optical Society of America, as well as free access journals. Proceedings of the National Academy of Sciences, USA, will be added soon. It is possible to extend the systems to other areas of interest such as medicine, agriculture, *etc*. Collaboration with FAO are on the way.

*2) Document Optimization and Transfer (*AidWorld*)*
The key to the success of the previous part of this project is the ability to manage the transfer of documents over low bandwidth connections (low communication speeds). In order to achieve this, practical research needs to be carried out into document optimization. This will build upon the existing work of Aidworld, ICTP, MIT TEK and academic research. The initial research will be into the retention of information in the conversion of documents from PDF, MSWord, HTML or other document formats, their optimization in order to reduce their size and therefore bandwidth requirements and the ability for this process to automatically respond to changes in bandwidth and connectivity.

*3) Development of Open Source Client and Server Software Tools (*AidWorld, ICTP)
Tools will be developed, to permit individuals and institutions working in areas of poor Internet connectivity and/or communications infrastructure to access materials that are currently too substantial to view.

b) To develop pilot projects which show cost effective ways to build and monitor the infrastructure for advanced wireless information networks

1) Provision of local Infrastructure (ICTP, IRE-NASU)
We propose to start a pilot project in an Institution without good connectivity, which is located not too far away from another one which has the needed infrastructure, it may be extended to other countries later on. At the moment, we have started discussions with the University of Douala in Cameroon, located near the Center of Excellence (well connected) and with IRE-NASU, in Kharkov, Ukraine. We plan to implement the activities listed below, considering the local technological needs specific to the two places. ***ICTP and the University of Douala*** have already signed a MoU to start collaboration on transfer of technology and the associated training.

2) Networking (ICTP, IRE-NASU)
▪ Integration of wireless networks into existing wired campus-wide network infrastructures:
Mobile connections or wireless LANs remove barriers, most of which are based on logical network architectures. The 802.11 Network will be implemented providing link-layer mobility. Such wireless networks require far more deployment planning due to the nature of the radio link. Every building has its own needs with respect to radio transmissions, and unexpected interference can pop up nearly everywhere because of multipath interference. As a result, each wireless LAN deployment is unique, careful planning and a meticulous site survey are required for each specific physical environment. (ICTP)

▪ Short-to-middle distance radio-links to connect Campus Intranets to the ISP or local Telecom infrastructures (ICTP)
a)The wireless technologies suitable for this integration and extensions include:

* Spread Spectrum - providing data transmission at 2 Mbps as the main alternative due to its proven reliability and sustainability over a few kms distances.
* Packet Radio - providing data transmission up to 19.2 Kbps depending on radio costs, distance limitation and geography. Reliable installation of a Packet Radio link will usually require a good TNC (Terminal Node Controller) -a professional one with specials protocols, a powerful radio and directional antennas.

b) To use Radio-System (MITRIS), designed, manufactured and tested in Ukraine, to provide broadband wireless point-to-multipoint communication. MITRIS is compatible with existing communication means (telephony, TV) and provides wireless telephone, Internet and TV accesses on multiuser and multichannel basis. It is prepared for serial production in microwave X-band (frequency ~10 GHz) with simultaneous operation of up to 60 channels having working range up to 40 km and data transfer rate up to 2Gb/s. Besides, an advanced version of that equipment has been designed and tested in Ka-band (frequency ~41GHz) for its usage in the nearest future. A demonstration can be provided to show how to achieve our goals in a cost effective way. (IRE-NASU)

*3) Testing and Deployment of Open Source Software Tools and Services (*AidWorld*)*

The research, and then the resulting proto-type tools, will be tested in a variety of field projects with partners in this project and with further interested parties including the UK Government. Field projects are likely to include the Universities of Douala in Cameroon, the African Institute for Mathematical Studies, Namibia Schools Network and the UNDP Afghanistan Information Management Service. The Aidworld group has contacts across development and relief work and can ensure that field testing of their work will be thorough and varied. The team includes highly experienced field workers accompanied by Computer technicians able to implement highly effective field trials.

c) To develop capacity building in ICT targeted to scientists, to guarantee the success of the pilot projects through the formation of several members of the local and regional institutions to continue the work:

1) Training on

- Wireless technology for local Area Networks, with special focus on the Spread Spectrum technology and the 802.11 family of wireless protocols at the site of the pilot project (ICTP).
- Network administration and system administration with special focus on Linux/Unix operating systems and Open Source technologies (AidWorld, ICTP, VUB).
- Ad-hoc training and consultancy (both locally or elsewhere) for specific needs in the field of wireless communications (ICTP, IRE)

2) Services

Training in Virtual Laboratories, dynamic embedded web contents; implementation of web hosting services (webmail, webDAV, distributed databases), exploitation of scientific information sources, www4mail, to allow scientists to browse and search the web via email, distance learning and e-learning with open source solutions, scientific documentation on-line (LaTex, MathML, XML…), implementation of tailored web-portals in a multicultural environment, distribution of open source software on CD ROM's upon request to developing countries users, etc. (ICTP, VUB, AidWorld)

d) To work out methods to create acceptable and sustainable Internet accesses for scientists, including those for monitoring and assessment to provide planning, expectation, troubleshooting and information for policy making.

● *Measuring output by Monitoring:* We will identify contacts in developing nations, select appropriate sites/hosts to monitor, set up the measurements to the site, work with contacts to ensure the measurements continue to be successful, extend the data organization, extraction, analysis and reporting to accept the new measurements, and gather the data from the monitoring sites more frequently. We will compare current and historical performance between sites on both sides of the Digital Divide, quantitatively identify regions with poor performance, identify long term trends, will discuss experiences, future work and possibilities for improvements. We will develop assessment tools that synthesize aid work and software development processes into methodologies that impact upon poverty reduction. We will make the data publicly available to

enable interested people to make their own analyses and to generate their own reports. (SLAC,ICTP,AidWorld)

● Assistance and training to set up a PingER active performance monitoring system to provide end-to-end measurements of performance between and within the University of Douala and other sites of relevance to the University. (SLAC)

- Regular gathering, archiving, analysis of the PingER data together with reporting of the results. (SLAC, ICTP)

d) To demonstrate the use of the new information technologies developed in the project for fast transmission of massive information through slow networks in developing countries to the exchange of massive data to generate and process SAR images applied to forecast environmental disasters and evolution of natural resources

1) To provide Remote Sensing Information with the help of the CONAE's satellites and to develop the tools and models to deal with it: (CONAE, STAC)

a) Training on the basic features of remote sensing technology. (CONAE,STAC)
b) Training on the processing of SAR data and images as well as SAC-C images. (CONAE,STAC)
c) To develop new tools for information extraction from optical and SAR images. (CONAE,STAC)
d) To provide simulated SAOCOM Mission data.(CONAE)
e) To provide airborne SAR simulated data and images. (CONAE)
f) To give access to parallel programming environment available at the Gulich Institute (Quadrix, PC clusters, others).(CONAE)

2) Use of the new information technologies and optical and SAR data developed in the project as well as radiometric surveys and traditional meteorological data to study and analyze the disaster processes like drought, flood, forest fires in Vietnam, in order to minimize its long term impact by taking remedial measures in time. Vietnam is a developing country located in the South-East Asia characterized by the tropical monsoon climate. Every year Vietnam has to face natural disaster like drought, flood, forest fires etc. with a heavy price in poverty and human lives. In order to reduce the long term impacts of those disasters to the Vietnamese people life and economy, these events should be forecasted early in order to produce emergency variants. With the development of the information and remote sensing technologies, especially the use of optical & SAR image processing, these disaster processes can be forecasted early on large areas and so act to diminish the damage. (STAC, in collaboration with CONAE)

B.6.1. Summary of Workplan description (full duration of project)

Workplan ***GS&D***	**Start date or starting event:01/01/04**
Participant id	
Person-months per participant 70	

Objectives

B.1 Objectives of the proposed project:

GS&D proposes approaches to: provide dramatically improved Internet performance utilizing wireless technologies; extend improved delivery of scientific literature to developing nations; provide measurements to identify and suggest solutions for problems of Internet performance to and within developing regions; and show an application of the use of remote sensing tools together with the use of fast data sharing via the Internet, for the prevention and recovery from environmental disasters as well as the evaluation of natural resources. This project represents a collaboration between scientists and teachers from institutions in Argentina, Belgium, Italy, Vietnam, UK, Ukraine and USA.

The main objectives can be summarized as:

- To elaborate methods and tools to **disseminate and transfer scientific knowledge** being appropriate and efficient for developing countries
- To **develop pilot projects** which show cost effective ways to build and monitor the infrastructure for advanced wireless information networks.
- To develop **capability building in ICT targeted to scientists,** to guarantee the success of the pilot projects through the formation of members of the local and regional institutions to continue the work.
- To develop methods to **create acceptable and sustainable Internet accesses** for scientists, including those for monitoring to provide planning, expectation, troubleshooting and information for policy making.
- **To validate the use of the new information technologies** developed in the project for fast transmission of large volumes of information through slow networks in developing countries to the exchange of massive data to generate and process Synthetic Aperture Radar and optical images applied to forecast environmental disasters and evolution of natural resources.

Description of work

At the first stage we propose to organize a meeting of all partners to establish guidelines and modes of operations where we shall identify, elaborate and coordinate:

a) the structure and block-diagram of local information Networks in Kharkov (IRE) and Cameroon (ICTP);

b) the appropriate set of hosts for PingER (SLAC,ICTP); updated scheme for eJDS and Internet access (Aidworld, ICTP, VUB);

c) disaster areas for data acquisition (STAC) methods for SAR image generation & processing (CONAE, IRE) .

This part is expected to run for 6 months.

At the second stage, from the 6th month, and running for 11, we shall attempt to construct, assemble and test:

a) hardware for the wireless information networks in Cameroon & Ukraine (ICTP, IRE-NASU);

b) methods & software tools for advanced eJournals system, access to Internet, PingER monitoring & delivery of simulated SAR images (ICTP, SLAC, Aidworld,VUB);

c) methods and software for SAR image generation, identification and processing, applied to evaluate disaster situations in Vietnam, Argentina & Ukraine (CONAE, STAC,IRE).

We shall organize training courses on the use of the developed tools in ICTP and on sites of usage (AidWorld, ICTP, SLAC, CONAE, STAC, IRE-NASU,VUB)

From the 15th to the 12th month, we shall try, upgrade and apply

a) hardware provided by ICTP and IRE-NASU;

b) the methods & software tools elaborated by ICTP, SLAC, Aidworld, & VUB

c) c) methods and software for SAR image generation by CONAE, STAC &IRE-NASU.

Preparation and submission of the reports.

Finally from the 20th month onwards we shall verify the objectives and prepare and submit the final report.

The acronyms in parenthesis represent the partner responsible for the execution of the task.

Definition of Acronyms:

ICTP- International Centre for Theoretical Physics

AidWorld – AidWorld Humanitarian ICT

CONAE – Comision Nacional de Actividades Espaciales

IRE-NASU - Usikov Institute for Radiophysics & Electronics (IRE), National Academy of Sciences

SLAC - Stanford Linear Accelerator Center (SLAC)

STAC - Space Technology Application Center (STAC) of the Institute of Physics of the National Centre for Natural Science and Technology

VUB - University Library of the Vrije Universiteit Brussel

Deliverables

We propose to deliver 9 reports along the execution of the project entitled:

D1: Identification, design and justification of the structure and block-diagrams of wireless information networks, as well as software for PingER & eJDS tools and for SAR image generation

D2: Wireless information networks tools for PingER & eJDS and software for SAR image generation, identification and processing for evaluation of probable disaster situations in Vietnam, Argentina & Ukraine.

D3: Training courses on the use of the developed tools in ICTP and on sites of usage.

D4: Wireless information networks deployed by ICTP in Cameroon.

D5: Wireless information networks deployed by IRE_NASU in Ukraine.

D6: Methods and software tools elaborated for PingER & eJDS systems.

D7: Methods and software for SAR image generation identification and processing for evaluation of probable disaster situations in Vietnam, Argentina & Ukraine.

D8: Methods and software for SAR image generation identification and processing for evaluation of probable disaster situations in Vietnam, Argentina & Ukraine.

D9: Final Report

Milestones[1]

- Outcome of the meeting of all participants of the Consortium to establish guidelines and modes of operations.

- Installation of wireless information networks in Ukraine and in Cameroun.

- Identification of disaster areas/evolution of natural resources for data acquisition and methods for SAR image generation & processing.

- Successful application of methods and software for SAR image generation.

- Identification of a potential monitoring site in a developing country to set up a PingER monitoring host tailored to their needs.

Expected results

To achieve means that will help developing countries to narrow the digital divide in a sustainable way. To enable as many scientists as possible from developing countries to access online literature and Internet information sources. To successfully install wireless information networks. To validate these technologies, with application to remote sensing forecast of environmental disasters and evolution of natural resources.

[1] Milestones are control points at which decisions are needed; for example concerning which of several technologies will be adopted as the basis for the next phase of the project.

B.6.2. Workplan list (full duration of project)

Work-Planning	Workplan List	Lead contractor No[2]	Person-months[3]	Start month[4]	End month[5]	Deliv-erable No[6]
Stage-1	**To identify, design and justify:**	**1**				**D1**
	a) structure and block-diagram of local information Networks in Cameroon	**1**	**30**	**0**	**6**	
	b) structure and block-diagram of local information Networks in Kharkov	**4**	**30**	**0**	**6**	
	c) to identify appropriate set of hosts for PingER, updated scheme for eJDS and Internet access	**5**	**26**	**0**	**6**	
	d) to identify disaster areas for data acquisition and methods for SAR image generation & processing	**6**	**40**	**0**	**6**	
	e) Meeting of all participants to establish guidelines and modes of operation	**1**	**10**	**0**	**6**	
Stage-2	**To construct, assemble & test:**	**1**	**-**	-	-	**D2**
	a) hardware for the wireless information networks in Cameroon	**1**	**44**	**6**	**16**	
	b) hardware for the wireless information networks in Ukraine	**4**	**70**	**6**	**16**	
	c) methods & software tools for advanced eJournals system, access to Internet, PingER monitoring & delivery of simulated SAR images	**7**	**12**	**6**	**16**	
	d) methods and software for SAR image generation, identification and processing applied to evaluate disaster situations in Vietnam, Argentina & Ukraine.	**3**	**44**	**6**	**16**	

[2] Number of the contractor leading the work in this work-plan.
[3] The total number of person-months allocated to each work-plan.
[4] Relative start date for the work in the specific work-plan, month 0 marking the start of the project, and all other start dates being relative to this start date.
[5] Relative end date, month 0 marking the start of the project, and all ends dates being relative to this start date.
[6] Deliverable number: Number for the deliverable(s)/result(s) mentioned in the work-plan: D1 - Dn.

	To organise training courses on the use of the developed tools in ICTP and on sites of usage (AidWorld, ICTP, SLAC, CONAE, STAC, IRE-NASU,VUB)	**2 & 1**	**72**	**6**	**16**	**D3**
Stage-3	**To try & upgrade:**					
	a) the wireless information networks provided by ICTP in Cameroon; preparation and submission of the sub-reports.	**1**	**20**	**15**	**20**	**D4**
	b) the wireless information networks provided by IRE_NASU in Ukraine; preparation and submission of the sub-reports.	**4**	**50**	**15**	**20**	**D5**
	c) and apply the methods & software tools elaborated by ICTP, SLAC, Aidworld, & VUB; preparation and submission of the sub-reports.	**7**	**24**	**15**	**20**	**D6**
	d) and apply the methods and software for SAR image generation by CONAE, STAC & IRE-NASU; preparation and submission of the sub-reports.	**3**	**20**	**15**	**20**	**D7**
Stage-4	**Validation of goals. Preparation and submission of the final report**	**1**	**8**	**20**	**24**	**D8**
	TOTAL		**500**			

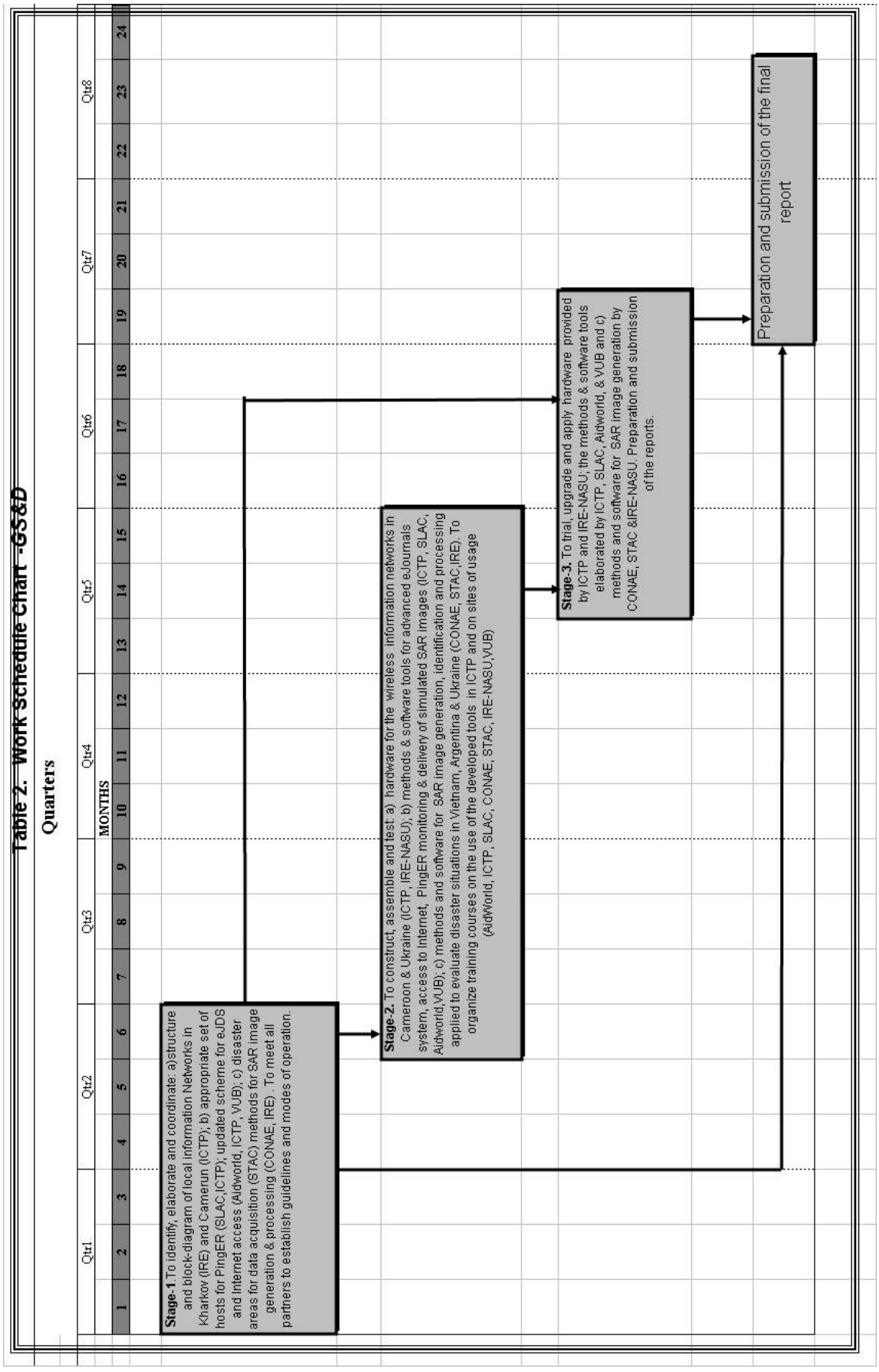
Table 2. Work Schedule Chart -GS&D
Quarters
Qtr1
Qtr2
Qtr3
Qtr4
Qtr5
Qtr6
Qtr7
Qtr8
MONTHS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Stage-1. To identify, elaborate and coordinate: a)structure and block-diagram of local information Networks in Kharkov (IRE) and Camerun (ICTP); b) appropriate set of hosts for PingER (SLAC,ICTP); updated scheme for eJDS and Internet access (Aidworld, ICTP, VUB); c) disaster areas for data acquisition (STAC) methods for SAR image generation & processing (CONAE, IRE). To meet all partners to establish guidelines and modes of operation.
Stage-2. To construct, assemble and test: a) hardware for the wireless information networks in Cameroon & Ukraine (ICTP, IRE-NASU); b) methods & software tools for advanced eJournals system, access to Internet, PingER monitoring & delivery of simulated SAR images (ICTP, SLAC, Aidworld,VUB); c) methods and software for SAR image generation, identification and processing applied to evaluate disaster situations in Vietnam, Argentina & Ukraine (CONAE, STAC,IRE). To organize training courses on the use of the developed tools in ICTP and on sites of usage (AidWorld, ICTP, SLAC, CONAE, STAC, IRE-NASU,VUB)
Stage-3. To trial, upgrade and apply hardware provided by ICTP and IRE-NASU; the methods & software tools elaborated by ICTP, SLAC, Aidworld, & VUB and c) methods and software for SAR image generation by CONAE, STAC &IRE-NASU. Preparation and submission of the reports.
Preparation and submission of the final report

B.6.3. Deliverables list (full duration of project)

Deliverable No[7]	Deliverable title	Delivery date [8]	Nature [9]	Dissemination level [10]
D1	**Identification, design and justification of the structure and block-diagrams of wireless information networks, as well as software for PingER & eJDS tools and for SAR image generation**	6	R	**PU**
D2	**Wireless information networks tools for PingER & eJDS and software for SAR image generation, identification and processing for evaluation of probable disaster situations in Vietnam, Argentina & Ukraine**	16	R	**PU**
D3	**Training courses on the use of the developed tools in ICTP and on sites of usage**	16	R	**PU**
D4	**Wireless information networks deployed by ICTP in Cameroon**	20	R	**PU**
D5	**Wireless information networks deployed by IRE_NASU in Ukraine**	20	R	**PU**
D6	**Methods and software tools elaborated for PingER & eJDS systems**	20	R	**PU**
D7	**Methods and software for SAR image generation identification and processing for evaluation of probable disaster situations in Vietnam, Argentina & Ukraine**	20	R	**PU**
D8	Final Report	24	R	**PU**

[7] Deliverable numbers in order of delivery dates: D1 – Dn

[8] Month in which the deliverables will be available. Month 0 marking the start of the project, and all delivery dates being relative to this start date.

[9] Please indicate the nature of the deliverable using one of the following codes:

R = Report
P = Prototype
D = Demonstrator
O = Other

[10] Please indicate the dissemination level using one of the following codes:

PU = Public
PP = Restricted to other programme participants (including the Commission Services).
RE = Restricted to a group specified by the consortium (including the Commission Services).
CO = Confidential, only for members of the consortium (including the Commission Services).