Healthcare networks

The role that satellite has carved out for itself in government services is significant and is valuable in so many different ways. Satellite now forms a crucial part of health networks across the world whether it is in developed or underdeveloped areas. Helen Jameson finds out how.

Every person in every village, town and city across the world relies upon services provided by their local and national government. These services include everything from security, education, law, order and justice, welfare and benefit systems to the collection of refuse. The systems in place to facilitate these services are extremely important and must support this wide spectrum of requirements.

A key element of government services, and one of the most important, is health. No matter who you are or where you are, at some point you will seek medical advice. Satellite networks are increasingly becoming a key feature of healthcare both in the developed and developing world. Telemedicine and e-Health delivered via satellite ensure that information and services critical to health are made available to all, not simply those who live in towns and cities but to those who live in remote communities cut-off from the hospitals and health centres that more densely populated areas can find on their doorstep. Today, satellite represents a cost-effective and reliable solution that can support a plethora of applications. Geographical location becomes irrelevant with satellite. Whether you are half way up a mountain or at the bottom of a valley, it does not matter – you can still have access to healthcare.

The benefits

Telemedicine equals many social and economic benefits for a country. Patients can be referred to hospitals without the need for travel, and trauma, which costs both time and money for people who cannot afford it. It enables remote healthcare workers to access specialists in city hospitals where facilities are much more comprehensive. These same healthcare workers can constantly top-up and refresh their knowledge and train via the Internet. Drugs can also be ordered remotely. Governments can ensure that all and not just some parts of a country will receive adequate healthcare. Benefits include:

- Reduced travel;
- Improved consultation;
- Universal service;
- Cost savings; and
- Reduced waiting lists.

Applications:

- Remote diagnostics;
- Training for healthcare professionals;

- Response to disaster situations;
- Connecting remote areas to hospitals;
- Second opinions; and
- Education for those living in 'at risk' areas.

The TMA Bridge: interoperability in telemedicine for Europe

The TM Alliance consortium was formed under the auspices of the Information Society Technologies (IST) Directorate of the EC. It is a partnership between three prominent organisations, ESA, the WHO (World Health Organisation, European Office for Integrated Health Care Services, Barcelona), and ITU (International Telecommunication Union, Telecommunication Development Bureau, Geneva). This partnership, coordinated by ESA, ESTEC, Human Space Flight, Microgravity and Exploration Directorate, is now in its second phase of work, known as TMA Bridge.

The first phase of this project saw the formulation of an overlying policy for the application of telemedicine in support of, primarily, the European citizen by the year 2010. The strategic goal is the improvement of public health and quality of life, adapting to changing needs and utilising existing and new technological capabilities, while at the same time increasing the efficiency and cost-effectiveness of these services.

The TM Alliance's Vision is therefore one of citizen-centred healthcare; the system should be built around the citizen rather than bending the citizen to fit into the system. In this vision, the citizen is the client who should be in a position to demand good services rather than the supplicant who is grateful for whatever services are thrown his way. The road towards citizen-centred healthcare must be clearly drawn, built on a solid foundation, and paved with concrete goals, as underlined in this Vision.

There have been many stumbling blocks in the first phase of the project. The results of the first phase pointed to the critical importance of first establishing a solid basis of standards and interoperability, before progress and necessary investment can be made. The lack of technical standards and medical coding systems was identified as being a major show-stopper for progress towards Telemedicine and eHealth implementation.

The second phase of the TMA focused on building the bridge between the Vision and its realisation, and is aimed at promoting the creation of a European eHealth Area, favouring the mobility aspects in the European Union. To do so the project will tackle the barriers to the achievement of a real mobility space for EU citizens, and facilitate citizen-centred healthcare services. Emphasis is on all echelons of interoperability required for the cooperation of different health systems, such as technical, organisational, social and political.

The Telemedicine Alliance has now successfully finished its second phase called TMA-Bridge - A Bridge Towards Coordinated eHealth Implementation in Europe - focusing on eHealth interoperability and mobility aspects of European citizens, and delivered a set relevant reports and recommendations to the European Commission.

Telemedicine in action - Africa

Africa presents a prime example of a lack of infrastructure and ICT services and also a population that is regularly plagued by disease – it is a continent crying out for healthcare facilities.

Of all Africa, the World Health Organisation and the European Space Agency identified Sub-Saharan Africa as a key region that would benefit from satellite-based healthcare. It comprises a total of 47 countries and a massive 750 million people and is stricken by communicable diseases such as tuberculosis, malaria and HIV and AIDS. The average life expectancy in 2004 was just 46 years. Health service coverage is very low with a shortage of skilled personnel attending at births and a low immunisation rate. The serious crisis in the health workforce is exacerbated by the fact that many indigenous healthcare professionals are leaving their country to work in the developed world and leaving a gaping hole at home.

Photo courtesy of Medecins Sans Frontieres.

As a result of a series of demonstrations carried out by ESA as part of the European Union Strategy for Africa, there were three key areas that were identified as candidates for satellite-based solutions. They were:

- Health Workforce – increasing numbers of skilled personnel, quality of skills and improving performance;
- Clinical Services – increasing coverage of available services and reaching isolated areas; and
- Strengthening intelligence gathering capacity of health systems and their ability to use this information for decision making.

ICT has been recognised as an important enabler by the African administrations towards the goals mentioned above but before these issues can be resolved there is the question of low penetration, lack of computers and lack of infrastructure to deliver the services required. This is where satellite comes in. Using affordable satellite technology such as VSAT, the infrastructure can be completed regardless of location and remoteness. It provides the perfect solution to the problem. However, in order to make telemedicine work for all, the integration of the system depends upon the education and heightening of awareness of the end users and also the stakeholders.

Success in South Africa

The use of distance learning has created a knowledgeable and efficient workforce. A project in Free State, South Africa has seen the development of the ICAM project (Interactive Learning, Communications and Management). This is a satellite-based project initiated by the Free State Department of Health who had previously been training their staff through a face-to-face workshop-based system. The training given was often not well attended, was costly and meant that a loss of work hours resulted as the staff had to be taken off duty to attend. So, following the lead of a major bank that provided training through a satellite-based system, ICAM was developed. The project now boasts 40 interactive, video-based classrooms that allow two-way communication.

The hub is based at Bloemfontein where a presenter broadcasts to students and can reach, train, communicate and interact with the participants through voice and data. There has proved to be no addi-

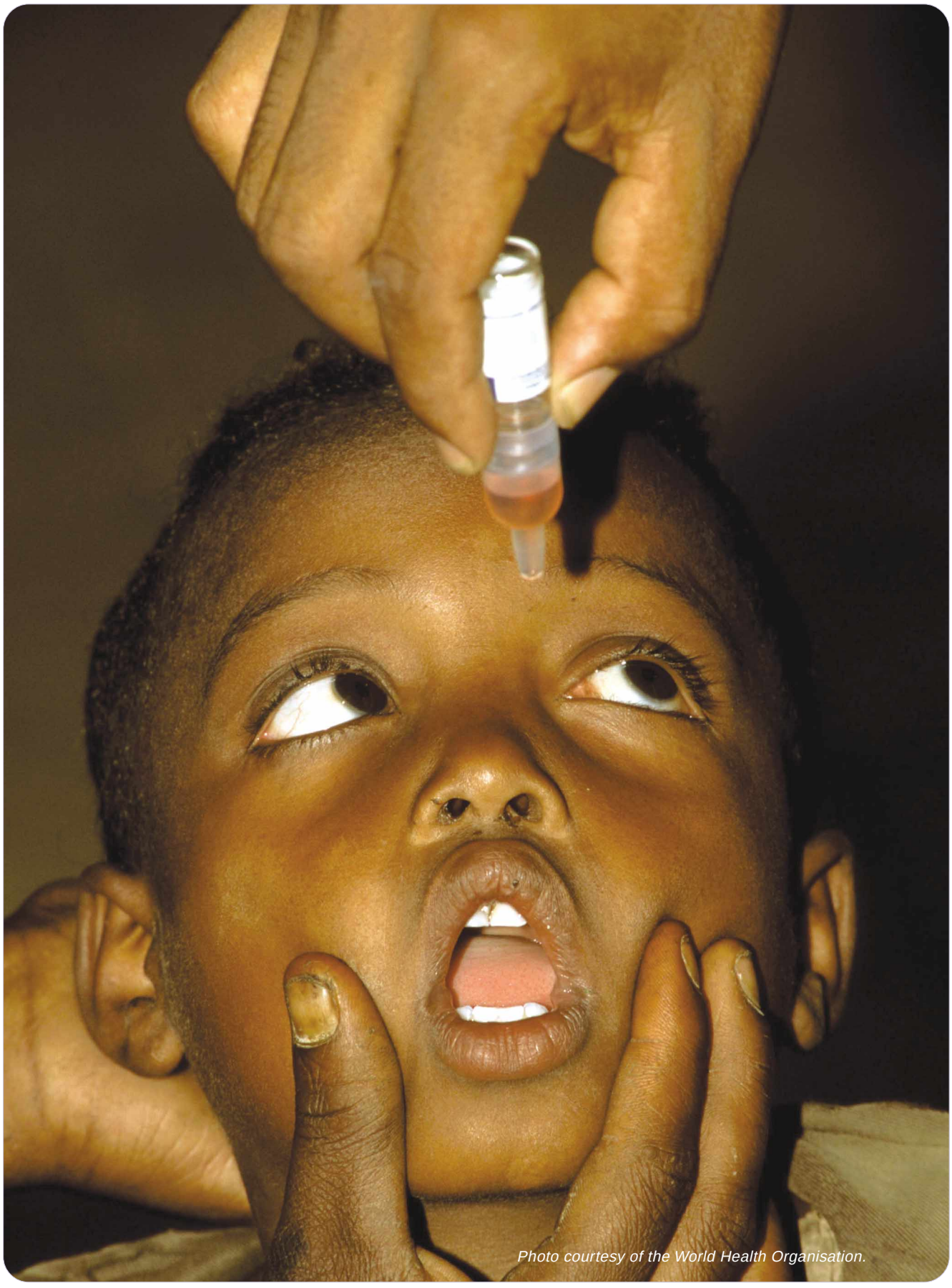

Photo courtesy of the World Health Organisation.

tional expenditure compared with the workshops used before, and a low level of isolation was noted by the participants. Its success has meant that the Department of Health now recommends that all training should be given via the system and ICAM now trains governmental and non-governmental organisations in a cost-effective way with a very limited loss of productivity. It is just one example of the huge potential for the use of technology to address training and development challenges.

Satellife PDA Project

This project was inspired and led by SATELLIFE, a non-profit organisation based in Massachusetts, USA. SATELLIFE's mission is to improve health in the world's poorest nations through the innovative use of ICT.

The goal of the SATELLIFE PDA Project was to demonstrate the viability of handheld computers or PDAs for addressing the digital divide among health professionals working in Africa. Started for the first time at the end of 2001, the project uses affordable technologies to link health professionals in developing countries to each other and to reliable sources of information, including modem-to-modem telephone links and the internet by using geostationary satellites.

The organisers believe Information and Communications Technology (ICT) can play an important role in combating disease and improving healthcare. The project used ICT as a tool to collect community health information to support decision-making; improving doctors' access to current medical information; linking healthcare professionals so they could share information and knowledge; and enhancing health administration, remote diagnostics, and distribution of medical supplies.

The project-explored questions related to the selection and design of appropriate, affordable technology and locally relevant content for use in African healthcare environment, specifically targeted at assessing the usefulness of the PDA for data collection and information dissemination. Physicians, medical officers, and medical students tested the PDA in the context of their daily work environments in order to gain a perspective on the real issues that affect the adoption of technology.

The PDA used was the Handspring Visor Neo, with a 33MHz DragonBall VZ microprocessor from Motorola, a Palm operating system (Palm OS), and 8 MB of main memory. Pendragon Forms v3.1 was the software programme used to create the survey forms. Country-specific drug lists and treatment guidelines were obtained by SATELLIFE in hard copy or electronic formats and adapted to a PDA-accessible format. Medical texts were obtained from Skyscape.

The project was conducted in three phases. SATELLIFE first put the handheld computers to use for field surveys, by linking this project to a widespread measles immunisation campaign being conducted in Ghana by the American Red Cross (ARC) in December 2001. The SATELLIFE-Arc joint effort used 30 PDAs in a short-term survey intended to determine the efficacy of the measles immunisation campaign outreach efforts and collect some baseline health information. The Uganda phase tested the use and usefulness of 40 PDAs by medical practitioners to conduct an epidemiological survey on malaria, and to access and use medical reference tools and texts. The Kenya phase tested the use and usefulness of 40 PDAs by students to collect field survey information, and to access and use medical reference tools and texts as part of their studies.

Nigeria

AMD Telemedicine of Massachusetts is providing equipment for a telemedicine project in Nigeria. The project, funded by the Nigerian Space Research and Development Agency (NASRDA), comprises nine sites and telemedicine equipment in two hospitals, Ibadan Teaching Hosptial and Maiduguri Teaching Hospital plus several other clinics. A mobile clinic, in the form of a bus, will also be used to proide services to remote areas.

The project is using the Nigcomsat-1 satellite that sends information from the bus back to the hospitals. Nigcomsat-1 is Nigeria's most advanced communications satellite and provides much needed capacity. The satellite was launched on 14 May 2007 and is the third Nigerian satellite in orbit.

Virtual Doctor Clinics – a project for zambia

The Virtual Doctor Project is a telemedicine project focused on the Zambian region. Set up by a non-profit organisation, Virtual Development Community Interest Company, the project is in its research and development phase but hopes to initiate a pilot project in 2009 where an off road vehicle, with satellite link, will travel to locations in Zambia to deliver healthcare to those in hard to reach areas.

The basic healthcare service offered by the project will be provided by mobile telemedicine units potentially comprised of an off-road vehicle staffed by a medical licentiate and a project officer who will be responsible for the logistical and technical aspects of the unit and driving the vehicle. These mobile units will travel between predesignated sites and establish a temporary 'virtual doctor' clinic for several days. Using basic testing equipment and medical supplies brought by the unit the clinic will offer a basic healthcare service performed by the staff with support available for the most complex cases from a volunteer doctor in a remote location. In these cases the staff will record the patient's symptoms and vital signs on a laptop, then send the information via email with attached digital photographs and test results to a qualified doctor in a distant location using a satellite link. Diagnostic advice will be returned by the following day and then can either be used to assist on-site treatment or to recommend referral to hospital.

All of the required equipment for the clinic will be transported between locations in the back of the vehicle and then assembled on site. Particular attention will be paid to ensuring that the hygiene and cleanliness of the unit is maintained and that the effect of sand, dust and dirt on the equipment is minimised. All sensitive equipment will be transported and stored in protective flight cases in the vehicle and the robustness and suitability to the harsh African environment will be a key factor in assessing the suitability of any item for use by the clinic.

The equipment for the telemedicine email system is very simple, easy to use and portable and consists of a hardwearing laptop and a satellite terminal unit that is similar in shape but smaller than a laptop and designed for that environment. Both emailing and VoIP are possible at a low cost via the RBGAN or Thuraya satellite networks.

From May to December 2009, the pilot project will be undertaken in the Mwanya/Kakumbi area of north east Zambia. This will allow the project team to develop procedures and test the efficacy of the store and forward telemedicine system. If it is successful, funding can be secured and a number of clinics will be introduced to the region.

Eutelsat – at the forefront of telemedicine

Eutelsat offers a wide range of telemedicine applications through their fleet of satellites, helping healthcare professionals to share valuable medical expertise and know how across borders and continents. Telemedicine applications are neither hindered by limited terrestrial communications networks nor limited in any type of information they can exchange. Applications offered offline include:

- X-Ray, radiography, MRI;
- Electrocardiography;
- Blood pressure, temperature and weight monitoring;
- Ultrasound images; and
- Scans.

Real time services with video or image content and remote control are offered for:

- Teleconsultation;

"In a pressing situation, where lives are at great risk, a quick and accurate decision must be made on the treatment to be given to a patient. For example, can they be moved? How stable are they? The Reference Hospital can provide invaluable support to those dealing with victims at the front line of a disaster."

- Teleteaching;
- Videoconferencing;
- Real time diagnosis in radio imagery;
- Emergency diagnosis; and
- Intraoperative pathology.

When a medical professional needs a telemedicine system to interact 'live' in the examination of a patient on the other side of the world, diagnostic images, data and sound must be sent and received in real time, in high resolution and with guaranteed confidentiality.

Eutelsat's telemedicine solutions are linked in a broadband satellite network architecture. The advantages of using a satellite network solution are numerous:

- Instant access to communities worldwide;
- Rapid network deployment;
- Broadband multimedia broadband transmission;
- Communications costs independent of transmission distance;
- Point to multipoint connectivity in any area irrespective of terrestrial infrastructure;
- Interoperability with terrestrial infrastructure; and
- Highly secure, reliable, cost effective communications.

Eutelsat's fleet of 23 satellites covers Europe, the Middle East, Africa, North America, South America, South and South East Asia and enables the most complex medical content to be transferred via satellite at high speed, in real time. Their services are available from any site, securely.

WoTeSa, WinVicos and DELTASS

Eutelsat works with industrial and medical partners to offer both hardware and software solutions designed for telemedicine services, establishing communications between medical centres and enabling them to exchange information and critical data. The Telemedicine Workstation combines WoTeSa (Workstation for Telemedical Application via Satellite) with WinVicos (video communications software). WinVicos is a high end, interactive communications software providing real time imagery, video and audio transmission. It has been widely used within the GALENOS project (a successful pilot project co-funded by the European Commission), as a standardised interface for exchanging medical images and is now used in the telemedicine network.

DELTASS or the Disaster Emergency Logistic Telemedicine Advanced Satellite System provides telemedical services for disaster situations using satellite-based systems where terrestrial infrastructure has been destroyed. The systems are quick and easy to deploy and use the Inmarsat, Globalstar and Eutelsat satellite systems. This is how it works:

Mobile Teams are deployed at the site of the disaster to seek out the injured and to provide triage services. They then communicate the status of the victims to a Mobile Field Hospital using low-rate and medium-rate satellite telecommunications systems. They are also tracked using GPS technology. The mobile satellite systems utilised for this purpose are the Globalstar fleet (for low rate communications) and the Inmarsat fleet (for medium rate communications). The search and rescue teams are equipped with PDAs and mobile telephones and the first aid and ambulance teams with Portable Telemedicine Workstations.

The Permanent Centre, located outside the disaster zone acts as a support for those in the field. It is unique to DELTASS. The Permanent Centre bridges the gap from the initial time of the disaster to when a Mobile Field Hospital can be set up which may take anything between six and twelve hours to deploy. The Permanent Centre is equipped with terrestrial gateways to the Globalstar and Inmarsat systems and acts as the point of coordination.

When the Mobile Field Hospital is deployed it will take over coordination of the mobile teams at the site, the victim triage and first aid, conditioning for transport, management of patient data and also will provide advanced medical care via a link to a Reference Hospital.

Once again, the Mobile Field Hospital is equipped with the necessary satellite equipment including a VSAT linkway providing a 2Mbps communications channel via Eutelsat for the transfer of all logistical and medical data.

The Reference Hospital is located outside the disaster zone and has both terrestrial communications channels in order to communicate with the Mobile Field Hospital and the Permanent Centre. The Reference Hospital has the expertise to help the Mobile Field Hospital using the VSAT link, for diagnostic purposes such as live teleconsultations.

Interactive telemedicine services are so important because they can help teams at the Reference Hospital to help teams at the Mobile Field Hospital. In a pressing situation, where lives are at great risk, a quick and accurate decision must be made on the treatment to be given to a patient. For example, can they be moved? How stable are they? The Reference Hospital can provide invaluable support to those dealing with victims at the front line of a disaster. WoTeSa and WinVicos are used in these situations via a VSAT link.

A lifeline

To many people, all over the world, telemedicine is becoming a feature of their healthcare service and satellite is making this happen. As time goes by, the huge value to be found in delivering healthcare in this way is becoming more apparent. The benefits that telemedicine brings to governments are enormous and helps them to save money, reach the people that they have been unable to reach before, to provide valuable education on highly communicable diseases such as HIV and AIDS and to reduce waiting lists. The satellite systems used are incredibly flexible and scalable and also cost effective, reliable and most of all, secure.

If a person can make a virtual visit to their doctor, there are no transportation costs and less disruption. Now that the door is open with regard to satellite-based telemedicine, perhaps we will see a lot more medical tourism, who knows? The potential for these types of applications is huge. We have already seen how fast deployment in disaster situations can begin the task of saving lives immediately, not hours afterwards. Use of telemedical applications in the military is also of huge benefit. For a continent like Africa, telemedicine is already crucial but needs to be more widely used and well-funded. The pilot project being carried out will prove that these services are most definitely needed and long overdue and the majority governments do recognise the need for medical care regardless of location. We must pick up the telemedicine ball and run with it as it solves a great deal of problems that we all encounter in health services around the world everyday.