Amanda Parkin, marketing manager at approved design and build consultant to the NHS for integrated 
theatres and digital video communications, OR Networks, explains how, with the help of the company and its 
specialist equipment, Northumbrian surgeons successfully established a two-way audio/video link to their 
counterparts at a hospital in the foothills of Mount Kilimanjaro to enable them to train the Tanzanian surgeons in 
laparoscopic surgery.

Alongside opening up many new teaching opportunities in both the UK and Tanzania, the link-up has already saved 
countless lives.

An ‘unlikely partnership’

The seemingly rather unlikely partnership between these two distant hospitals began in 1999, when a fact-finding 
team from the Trust, led by Professor Richard Walker, visited KCMC for the first time to explore partnership 
opportunities. The management and staff at KCMC shared a vision to revolutionise the delivery of healthcare to the 
Tanzanian people, and, when the opportunity to partner with one of the world’s leading healthcare organisations 
presented itself, it was seized with both hands. The initiative gained support from the chief executives of both 
organisations, and initial funding was provided by the Department for International Development. Since then, the 
partnership has grown from four initial training objectives in clinical coding, physiotherapy, occupational 
therapy, and tissue viability, to include theatre nursing, ultrasound, emergency medicine, pharmacy, sterile services, and capital 
planning. However, it is the work undertaken in the field of laparoscopic, or “keyhole” surgery, that has presented 
particularly complex challenges, necessitating groundbreaking innovations in response. KCMC is a major specialist 
teaching hospital with 500 beds, serving the entire north-west of the country – over 11 million people. It is a huge 
complex, with over 1,000 staff, and hundreds of patients and visitors coming to the site every day. Historically, 
patients presenting with hernia or appendix problems were offered traditional open surgery, which carries with it all 
the problems associated with larger incisions and longer recovery periods, such as increased risk of postoperative 
infection. Laparoscopic surgery, on the other hand, requires only tiny incisions, there is a reduced risk of infection, and 
patients can be discharged a day or two after the operation, a huge bonus for the chronically overcrowded wards at 
KCMC. It is also relatively inexpensive. All in all, it was the ideal solution for doctors and patients at the hospital, but 
no surgeons there were trained to perform it. This is where the partnership with the Trust came into its own.

Idea for ‘an exchange’
The idea for an "exchange", which would allow surgeons at Northumbria Healthcare to train surgeons in Tanzania in laparoscopic surgery, came out of a conversation between Trust colleagues Liam Horgan, consultant surgeon, director of the Northern Skills Institute at Hexham General Hospital, and head laparoscopic surgeon at the Royal College of Surgeons in London, and Lillian Broatch, theatre nurse trainer. Initial funding for the project was raised; surgeons from Hexham left for Tanzania, and a laparoscopic team was set up at KCMC, led by Dr Chilonga Kondo. Preparing the hospital to perform laparoscopic surgery was not straightforward, and even equipment we take for granted in the UK sometimes had to be improvised. For example no medical grade carbon dioxide gas was available for insufflating the abdomen prior to surgery, but a canister from the local carbonated drinks factory was found to be almost as pure, much cheaper, and just as effective. Despite a power cut at the eleventh hour, the first laparoscopic removal of a gall bladder to be carried out in Tanzania took place at the hospital in 2004, performed by Mr Horgan. This was followed in 2005 by the first laparoscopic removal of an appendix and, in 2006, with the first laparoscopic repair of a hernia. As the service became more established, surgeons at Hexham became aware that it would be useful to have more regular contact with KCMC surgeons to offer ongoing professional support. It was suggested that this support could be provided via a visual link, whereby an operation being carried out at KCMC would be transmitted back to Hexham, to allow surgeons there to see what was going on in the African operating theatre, and offer step-by-step “telementoring” advice.

'A massive technical challenge'

Implementing the visual link was going to be a massive technical challenge. Fortunately, Liam Horgan and Lillian Broatch knew of a company which would be able to rise to that challenge. OR Networks is an established, experienced, healthcare communications design consultancy, specialising in ultra-modern theatres utilising surgical imaging and digital video communication systems – OR-TV. OR-TV transmits live surgical images for broadcast to a local seminar room, or across thousands of miles, via telecommunications systems. Although the system had worked successfully in British and other hospitals in developed countries, no one knew whether it could work in Tanzania. However, Colin Dobbyne, chairman of OR Networks, was as inspired by the project as the staff at the Trust and KCMC, and was determined to do anything he could to make it work. He and the OR Networks team began to look at just how the televisual link could be set up. The first approach was the reliable, proven one: satellite or ISDN transmissions. However, it was soon clear that there was no money available to buy either expensive equipment, or run the expensive airtime. After much head scratching, it became clear that the only hope was to use the internet, but the meagre 10 Mbps that links the entire town of Moshi, including the hospital, was not going to be sufficient. Link project manager Brenda Longstaff flew out to Tanzania to hold discussions with the Tanzanian Telecommunications Company, the TTCL, and get them on board, something which was essential if the project was to succeed. The TTCL was able to guarantee some free preferential bandwidth allowance, although the disparities between IT infrastructure in the UK and Tanzania, and the unpredictability of the worldwide web, were already making the project what Brenda Longstaff calls, “a high wire performance”.

'A wing and a prayer'

So, “on a wing and a prayer”, Colin Dobbyne packed his bag of technical tricks and headed off to Tanzania. He was met with some scepticism, but was not deterred, and, after a week or so, had installed twin ADSL lines, configured them into a modem, and connected that to a video encoder. The surgeon was given a tie clip microphone, a video feed was taken from his endoscope, and fingers were crossed from Tanzania to Hexham, and collective breaths held. TTCL had delivered on its promise, and the transmission received 1 Mbps (10% of the town’s total bandwidth). At the allotted hour, the BBC captured the fledgling transmission as it hopped across the Masai Steps via overland cable from town to town until it reached Dar es Salem, where it was bounced off a satellite 22,000 miles high to Israel, then picked up by a fibre cable running under the entire length of the Mediterranean, up the Atlantic coast of Spain and Portugal, into the English Channel and North Sea, and finally along the Thames Estuary to London. To everyone’s joy and relief, the principle had been proven – images could be relayed in real-time via the internet between Tanzania and Britain. OR Networks had succeeded in designing and building a unique bespoke system, which operated despite varying internet availability, reliability, and quality.
Telementoring project under way

So the link was up and running, and the telementoring project could begin. In laparoscopic surgery, the images are obtained by inserting a tiny camera into the abdomen of the patient. The images of the interior of the abdomen are shown on a TV monitor in the theatre, and the surgeon watches the TV screen as his hands move the laparoscopic surgical instrument inside the body. Surgeons at Hexham were able to see high quality images of the interior of the body of the patient being operated upon in Tanzania, as the operation actually took place. These images were transmitted across the internet to Hexham General Hospital. Through the audio link, the UK surgeon was able to speak to the Tanzanian surgeon about the images he saw on his computer, and provide advice and support as the operation actually happened. The Tanzanian surgeon was also able to speak to, but not see, the surgeon in the UK to ask questions about how to proceed. For the next year, the link operated successfully, with a one-way video and two-way audio link between the hospitals, and over 50 laparoscopic procedures were safely completed. However, laparoscopic surgery is very image-driven, and everyone involved in the project felt that if the video image could also be two-way, the training experience would be improved even further. In 2009, Colin Dobbyne returned to KCMC to install a new system that could manage the dramatic fluctuations in speed and even total absences of bandwidth for short periods. An important aspect of the system was that it was far more important for the Hexham surgeons to see good images of the patient, than for the KCMC surgeons to see a good picture of the surgeons they were talking to, so Colin installed an encoder which could be optimised to manage an asymmetrical allocation of bandwidth to up and down speeds. Once again, this encoder had to be designed and built specifically for the project, and OR Networks again met the challenge successfully.

Full potential being realised

The full potential of all the opportunities offered by the link between Hexham and KCMC is now being realised, as the entire partnership project continues to go from strength to strength. Over the years, the partnership has established a Physiotherapy BSc course, trained coders to use ICD10 to enable them to report to the World Health Organisation, trained 22 nurses in wound management, 15 nurses in theatre nursing skills, and 13 doctors and nurses to accurately predict foetal age. As far as the field of laparoscopy is concerned, the results have really been remarkable, and the project has far surpassed its initial design brief to facilitate surgical telementoring. Using equipment donated through the partnership, laparoscopic surgery can now be provided at a cost of $50 per patient in KCMC’s dedicated laparoscopic unit, and has saved countless lives already. The two-way link has also opened up a whole new area of teaching opportunities, with demonstrations in the UK being transmitted to medical students, nurses, and trainee surgeons, facilitating live tuition, operative training, and discussion forums. Surgeons from KCMC aim to share their knowledge by training doctors and nurses across the whole of the East African region, and in 2008 hosted the first Tanzanian Laparoscopic Cholecystectomy Course, enabling surgeons from Tanzania to gain an understanding of the benefit of laparoscopic surgery for patient care. Tsurani University, which is attached to KCMC, is currently working with Northumbria Healthcare NHS Foundation Trust to develop an MSc in Laparoscopic Surgery. This will be a first for Africa, and is not even offered in the UK. Perhaps even more important are the global opportunities presented by this groundbreaking work – the link created by OR Networks was not an expensive satellite connection, nor an unreliable PC-based instant messenger video telephone connection, but an affordable and workable internet connection, which can support distance learning, and literally transform the way operations are performed in less developed countries.

Pushing things to the limit

As link project manager Brenda Longstaff put it: “The KCMC telementoring project has been the most challenging and rewarding international project that the Northumbria Healthcare team has undertaken. Its final success came about as the telecommunications infrastructure was pushed to the limit by OR Networks and the Tanzanian Telecommunications Company. There was a shared vision by the whole team – surgeons, nurses, and engineers, that, although this sort of internet-based link had not been achieved before, they were determined to find a way to make it happen. It was international collaboration at its best.”