

# WHAT IS REMOTE SURGERY?

## THE LINDBERGH OPERATION

The New York offices of France Telecom are not the first place that springs to mind as the venue for a world first in gastric surgery. However, it was from these offices on Avenue of the Americas in Manhattan on 7th September 2001 that a team of French surgeons performed a surgical procedure to remove the gall bladder of a 68 year old woman.

The truly exciting thing about this routine procedure was that the patient was in Operating Block A, Strasbourg University Hospital, Strasbourg, France – over 6000 kilometres away from the surgeons carrying out the operation.

The 45 minute procedure was the first demonstration that remote surgery could be carried out at intercontinental distances. In commemoration of Charles Lindbergh's first solo, non stop transatlantic flight in May 1927 the procedure was christened the 'Lindbergh Operation'.

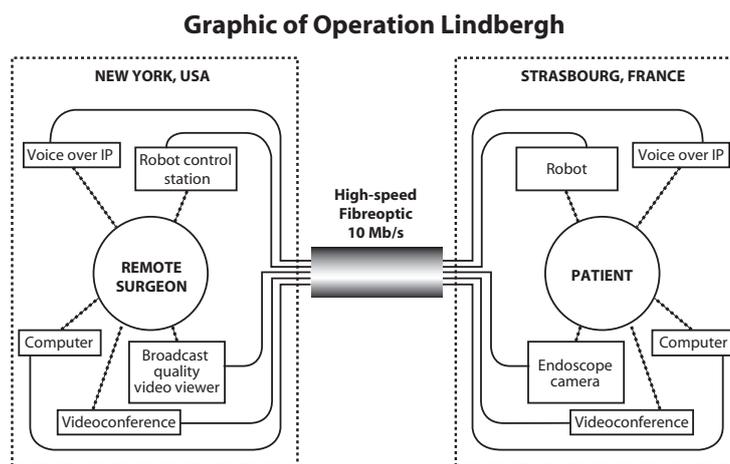


Diagram 1. The Lindbergh Operation – how they did it.

## HOW DOES REMOTE SURGERY WORK?

The basic principles of remote surgery are really simple:

- The patient is anaesthetised and taken to an operating theatre.
- A surgical robot is present in the operating theatre.
- The surgical robot is controlled remotely by a surgeon.
- The surgeon uses the robot to carry out the procedure as if they were present in theatre with the patient.

This really isn't as far fetched as it sounds. Many surgical procedures where the surgeon is present in theatre are already performed with the assistance of surgical robots. These robots can operate in much more confined spaces than a surgeon's hands, meaning that patients don't need to be cut open anywhere near as much as they may have done in the past.

The only difference is that with remote surgery the surgeon is not in the theatre with the patient.

## THE PROBLEMS

It may sound simple when you put it like that but there are some significant difficulties to overcome. The main one being the need to reduce the time delay or *latency* involved in the sending and receiving of signals. A delay of more than 200 milliseconds makes performing a delicate surgical procedure impossible. A satellite link can involve as much as a 600 millisecond delay and, as much of our communications is based on satellite technology, this is a problem for aspiring remote surgeons.

Another problem is agreeing communications protocols. Lack of standardisation means that not all remote surgery equipment is fully compatible. The necessary systems are also incredibly expensive and there may be some reluctance in hospitals to invest so much money in a system when any future standardisation of communications protocols might make it obsolete.



Fig. 1 The European Space Agency's Artemis; an example of a modern communications satellite.

Surgeons also report that the lack of 'feel' when controlling a surgical robot is difficult to compensate for. There is currently much research into the use of feedback systems and using touch sensation and control in surgical robotics. This relatively new field is called *haptics* and it will eventually allow surgeons to regain the sense of touch when they are dealing with a patient on the operating table.

## REMOTE SURGERY TODAY AND TOMORROW

Since 2001, remote surgery has progressed but it is still not a widespread technology. The benefits, however, in being able to have a world class specialist operating on a patient in South America in the morning and another patient in Europe in the afternoon are clear.

One of the possibilities for the future is that advances in surgical robotics may actually reduce or remove completely the need for remote surgery. It is estimated that there are currently around about 1000 research projects at universities around the world focused on surgical robotics. In 2007 over 50 per cent of prostate glands removed in the US were actually removed by robots.

The US military's Defence Advanced Research Projects Agency (DARPA) is in the process of developing a fully autonomous robotic Trauma Pod which will help to stabilise battlefield casualties until they can be evacuated to a hospital by treating blood loss and major injuries without human intervention. It is expected that this unit will be deployed initially in 2009!

Space scientists are also looking at autonomous surgical robots for use in future crewed bases on the moon and even Mars. Remote surgery in these locations simply isn't practical because of the time delays involved in signals from the Earth.

The benefits of remote surgery are clear, but it remains to be seen whether it is going to be overtaken by one of the technologies that made it possible in the first place.

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