# LapAR: Advancing Laparoscopic Training Through Augmented Reality and Objective Performance Metrics

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## Objective of the technology

The Inovus LapAR represents a significant advancement in surgical simulation by combining augmented reality (AR), computer vision-driven operative metric recording and advancements in simulated procedural models. The device addresses the increasing need for cost-effective, portable, and realistic simulation tools and aims to enhance the proficiency of surgical trainees and accelerate their learning by providing a highly accurate and engaging platform that bridges the gap between simulation and real-life operative experiences.

## Description of the technology and method of use

The LapAR platform integrates augmented reality visualisation with a physical laparoscopic training box, providing a seamless blend of digital and tactile feedback. The system consists of three primary components:

1. **Physical Laparoscopic Trainer:** Lightweight and portable, with advanced silicon-based models, replicate the tactile sensations of tissue handling and instrument manipulation whilst ensuring affordability.
2. **Augmented Reality Interface:** AR technology overlays lifelike, anatomically accurate surgical anatomy, offering a dynamic and interactive 3D environment.
3. **Performance Analytics Software:** Computer vision tracks metrics including handedness, precision, smoothness, and completion times, enabling objective performance assessment and personalised feedback. This is stored on a cloud-based interface, Totum, allowing for continued learning and reflection.

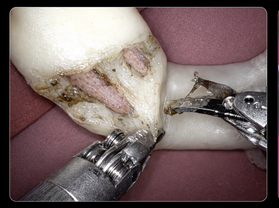

Figure 1: LABrange Cholecystectomy model compatible with energy.

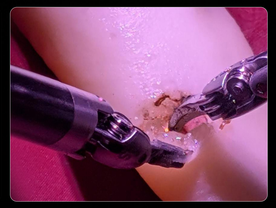

Figure 2: LABChole model 'synthetic cadaver' for robotic and laparoscopic cholecystectomy training.

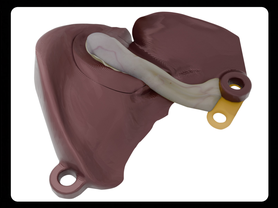

Figure 3: LABrange Liver and LABrange Cholecystectomy models.

The LapAR is compatible with standard laparoscopic instruments and can simulate a variety of procedural scenarios, including appendicectomy, cholecystectomy, adhesiolysis, closure of enterotomy and a spectrum of intra-peritoneal gynaecology procedures.
Its modular design facilitates scalability, accommodating trainees at various skill levels and surgical specialties.

## Preliminary results

A thorough evaluation process, aligned to the IDEAL framework was designed. IDEAL stage 1 studies showed that LapAR-based simulation has shown to significantly improve trainee operative self-confidence when integrated into training programmes. This improvement in self-confidence is maintained regardless of experience. Trainees using the LapAR technology showed progression in operative metrics over time and were able to meet a proficiency-based benchmark over the course of a single day. IDEAL stage 2a studies are ongoing, with 2b studies under proposal. This latest research will be available to present at SAGES 2026.

## Conclusions/future directions

The recording of operative metrics is novel, especially in an accessible and portable simulator. With the ability to record granular operative data, LapAR could revolutionise the way that surgeons train and considerably accelerate and support skill acquisition. Systematic evaluation of AR-based laparoscopic training and operative metric recording is being undertaken currently to ensure evidence-based integration into training programmes. New high-fidelity advanced models will be available to showcase at SAGES 2026.