

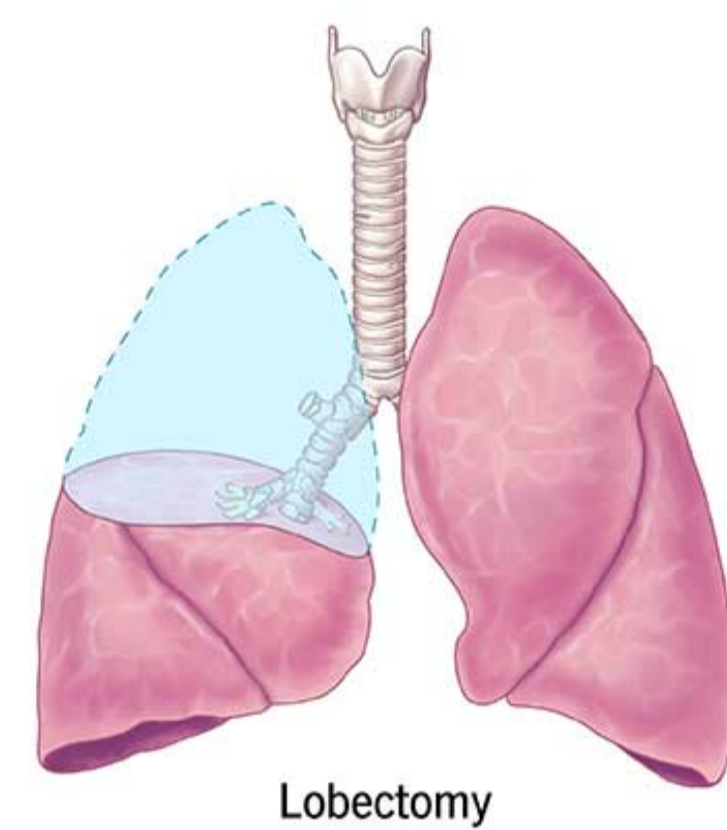
Surgical Robotic End Effector Design



Designing an innovative robotic surgical tool and exploring alternative solutions to increase the surgeon confidence when performing robotic surgery in the thoracic cavity.

Why it Matters

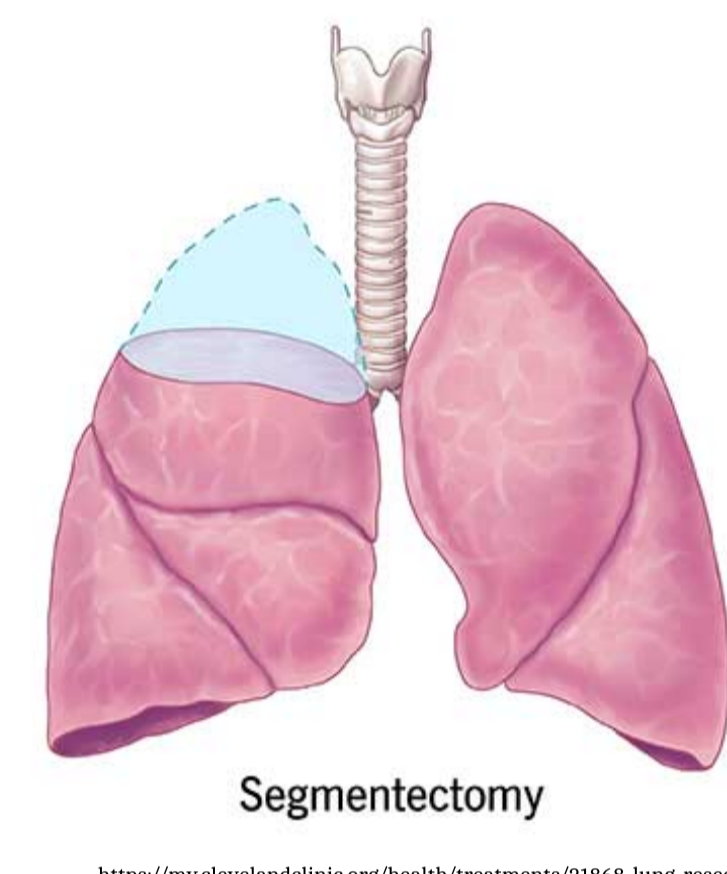
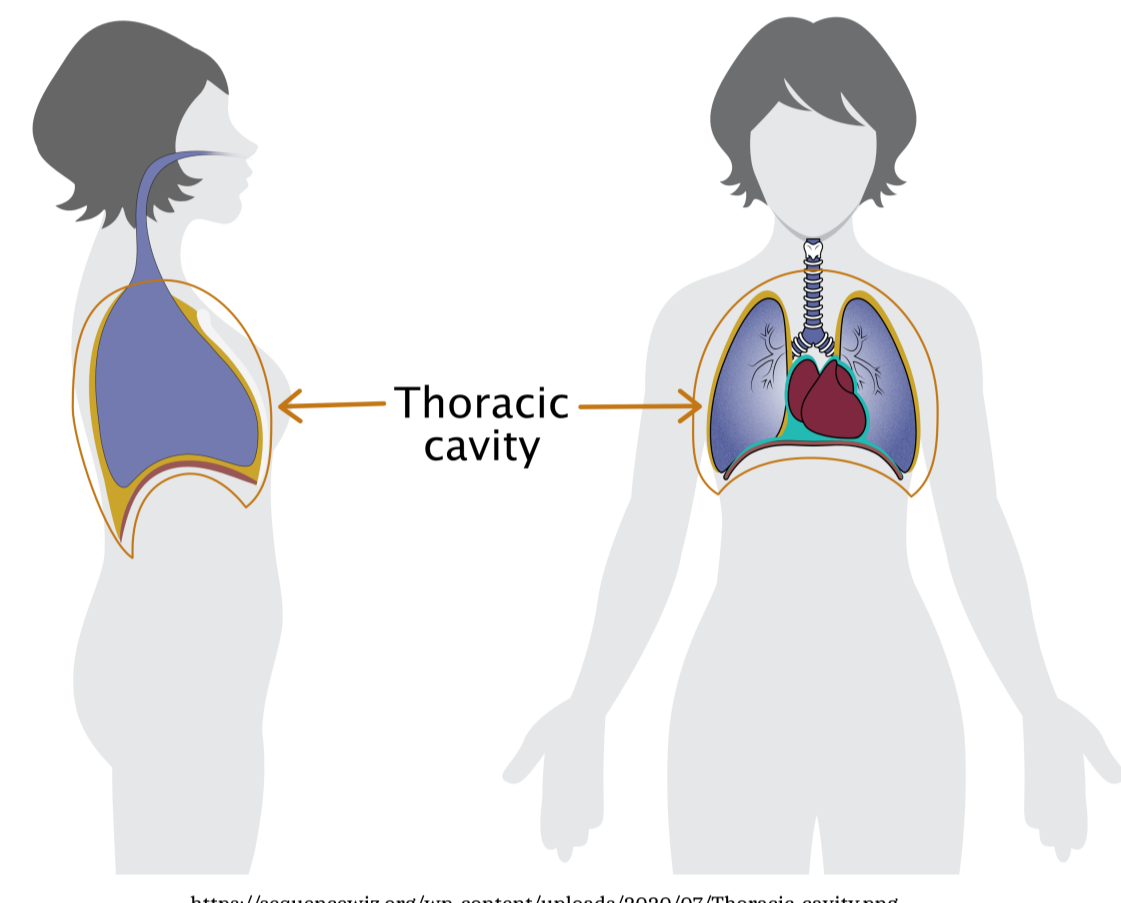
The thoracic cavity is the space on the body enclosed by the ribs. Surgeries in this space are called thoracic surgery.



Lobectomy

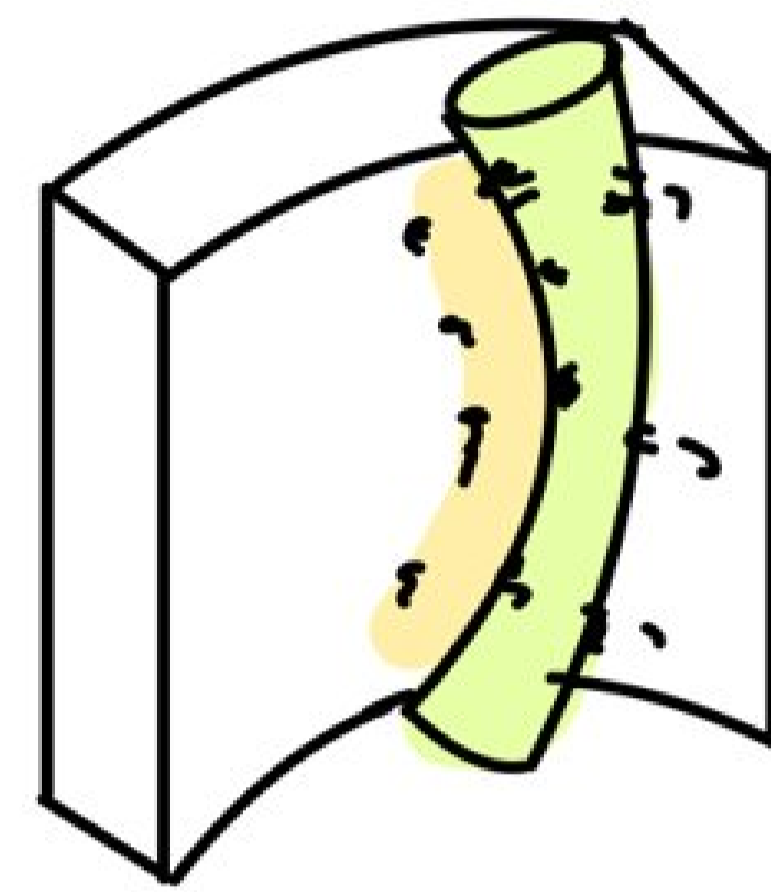
Lobectomies and segmentectomies are procedures that remove lobes or sections of the lung, often to remove tumors.

In 2014, there were **18,603** lung cancer thoracic surgeries and patient lives on the line.

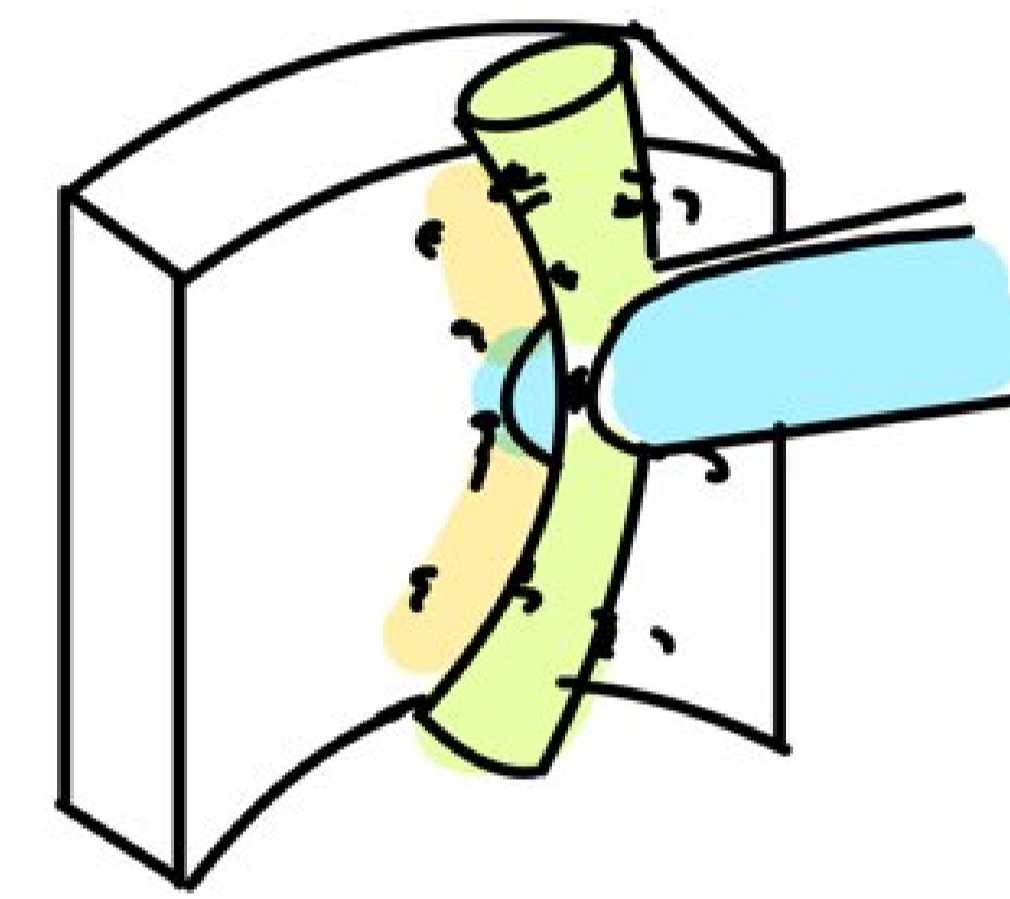


Segmentectomy

Vessel Isolation Task

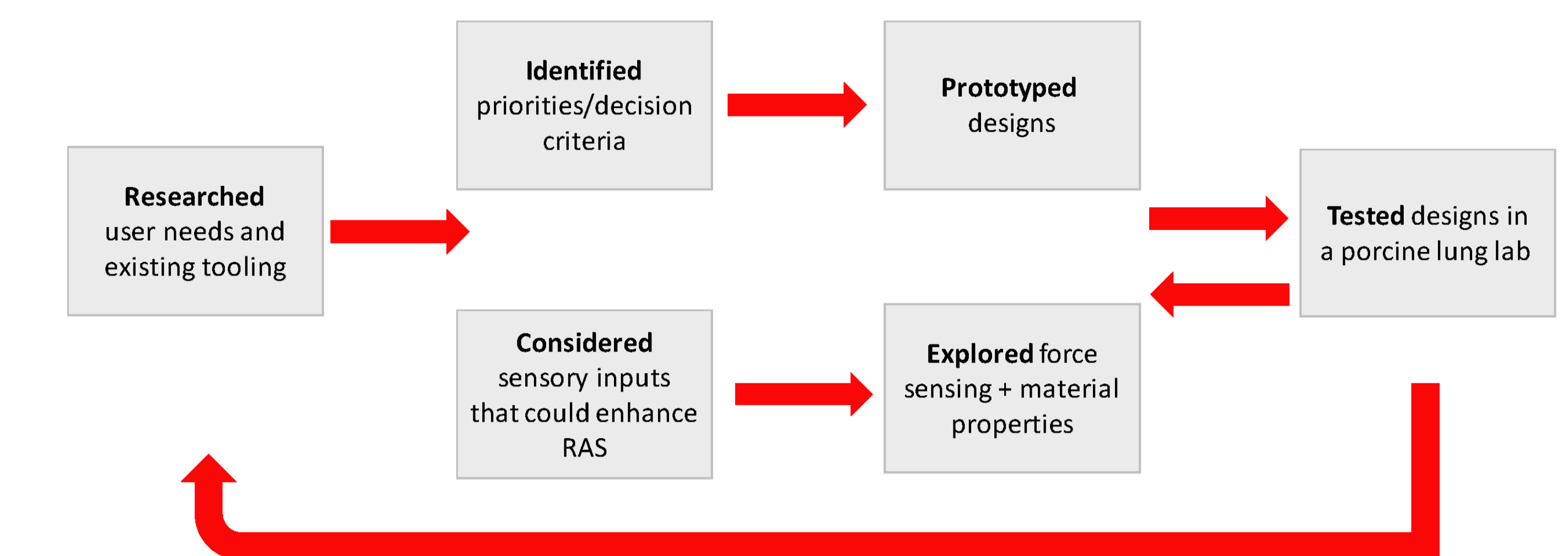


During lobectomies and segmentectomies, vessels carrying air or blood to and from the target sections of the lung must be sealed before removing those sections. Vessel isolation is the process of creating space for vessel sealing.



Our task was to design a specialized tool, or end effector, on a robotic surgical platform and explore alternative solutions to increase surgeon confidence during vessel isolation.

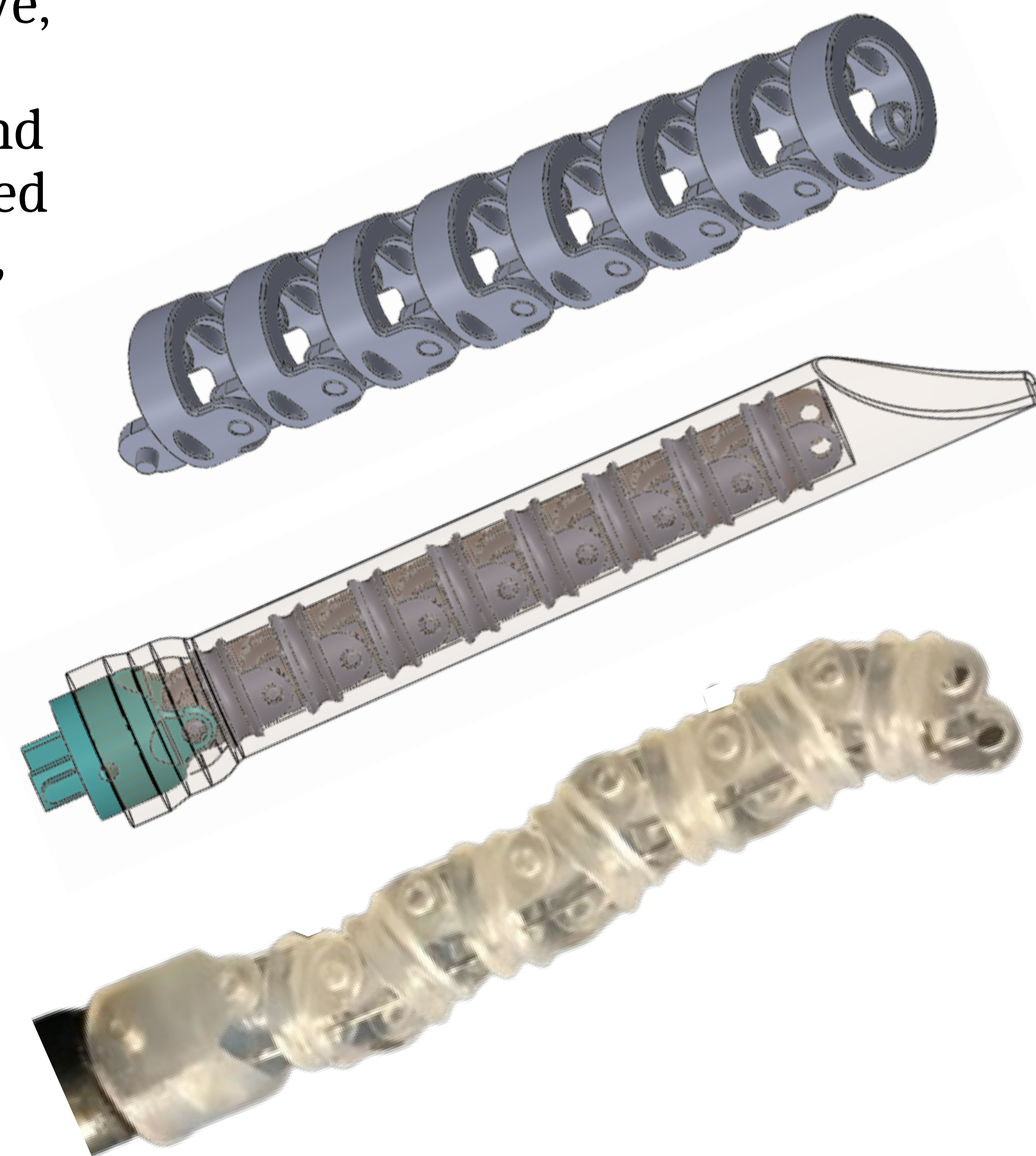
Process to Output



Throughout our process, we designed and tested **20+** solutions across **3** different fields resulting in **3** critical suggestions that will prevent dead-end explorations and shine light on how to continue this project.

Suggested End Effector

We created and suggested an innovative, cable-driven, curling end effector with discrete links to loop around vessels and create space. Proof of concept testing led us to believe this tool, with refinement, would provide surgeons with more confidence in vessel isolation.



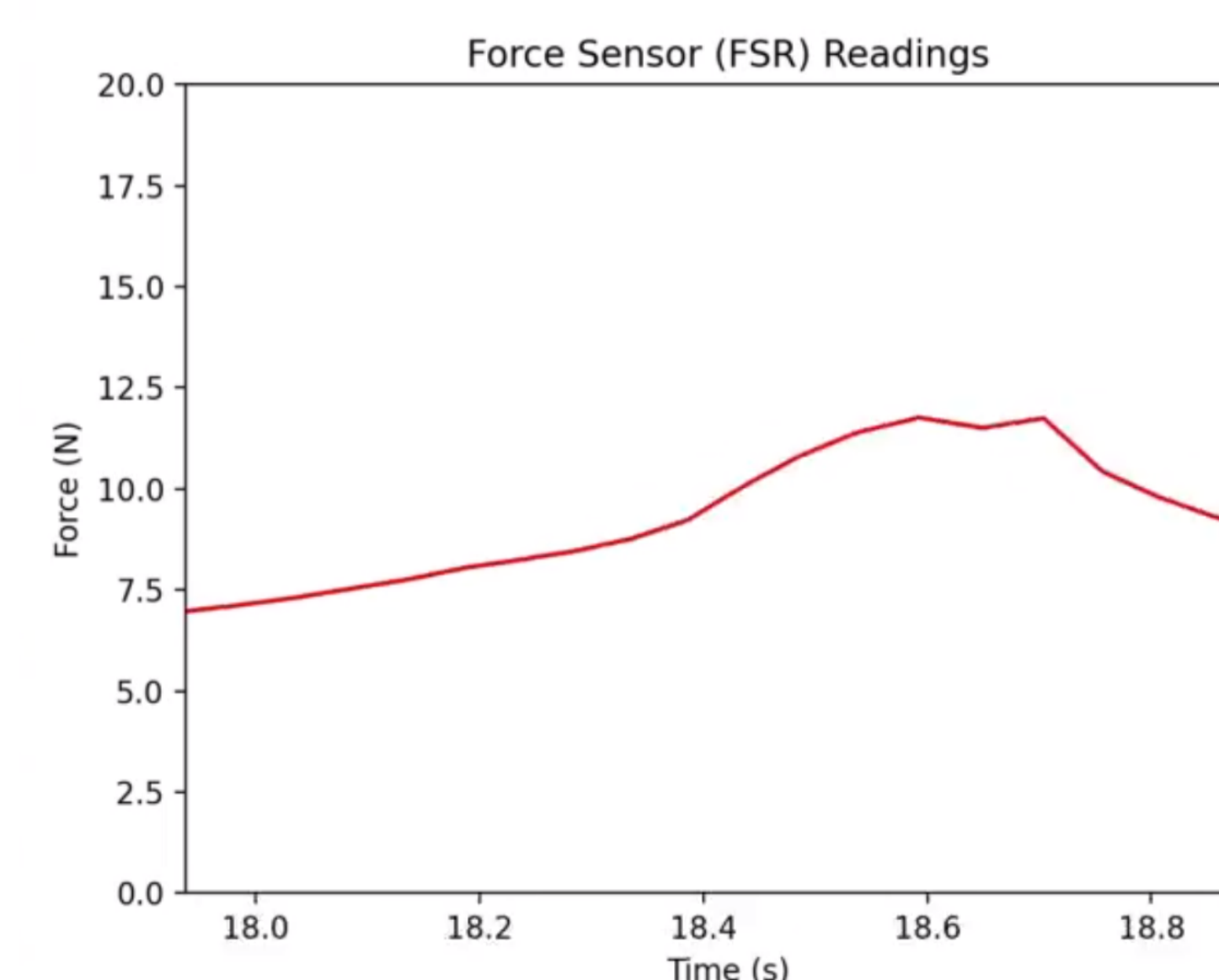
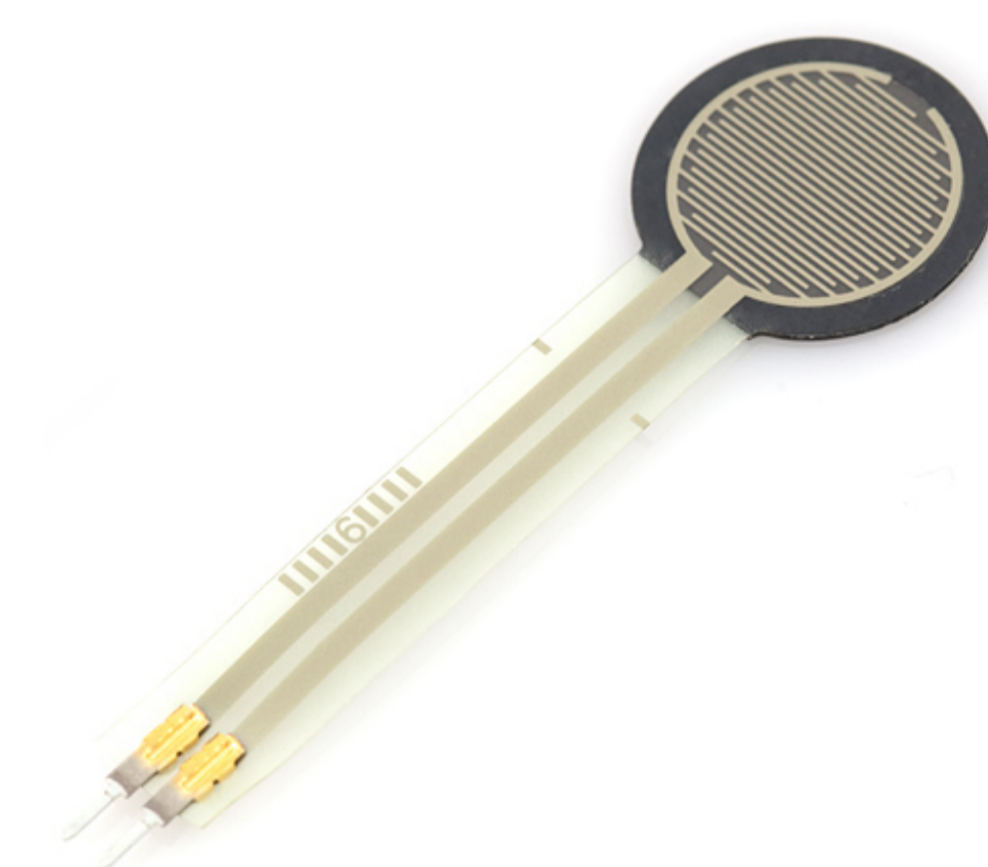
Exploration Findings and Suggestions

Information

While tools themselves can improve surgeon confidence, providing more information could have a similar impact.

Force sensors could help reassure surgeons and replace the lost sense of touch. However, they are a distraction with complex UI or unclear readings.

Moving forward, high fidelity sensors are needed to ensure the information is correct and the feedback must be seamlessly integrated or appeal to another sense like haptic feedback.



Soft Robotics



Soft robotics are ideal because they minimize unintended force on vessels. Material combinations should be determined by desired behaviour. With modification of J&J's control setup, and thorough quality testing, we propose pursuing pneumatic tooling.



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