

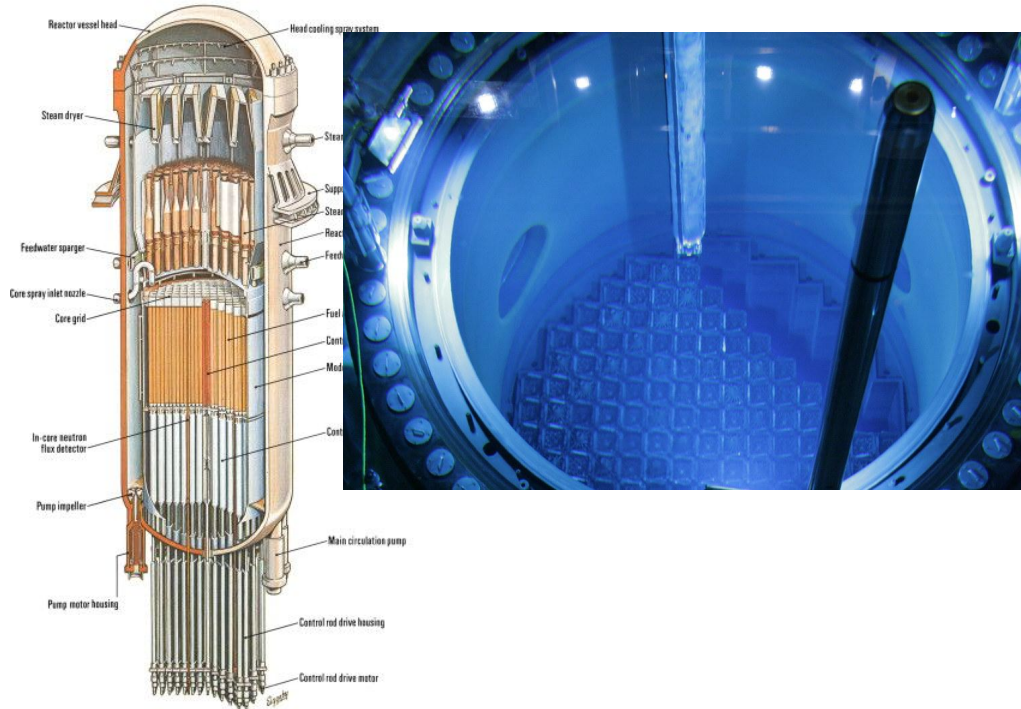
It's not just about the robots anymore...

David Mintz
Auris Health
VP R&D



Multiple solutions to a well defined problem

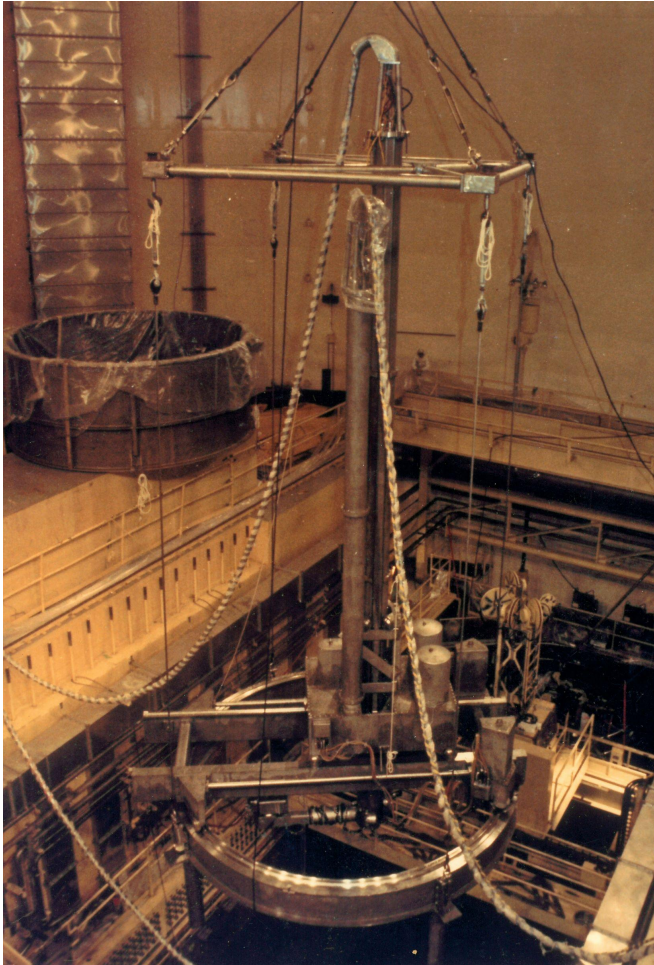
Reactor vessel and internals



Inspect all welds in a nuclear reactor containment vessel

- 6 - 7 M in diameter
- 20 - 30 M deep
- .3 M Thick steel
- Bottom of a 30 M trench
- Filled with borated water contaminated with high level radioactive debris

ARIS II

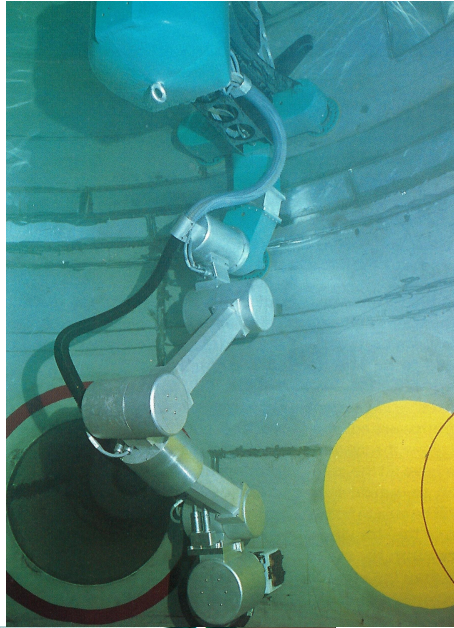
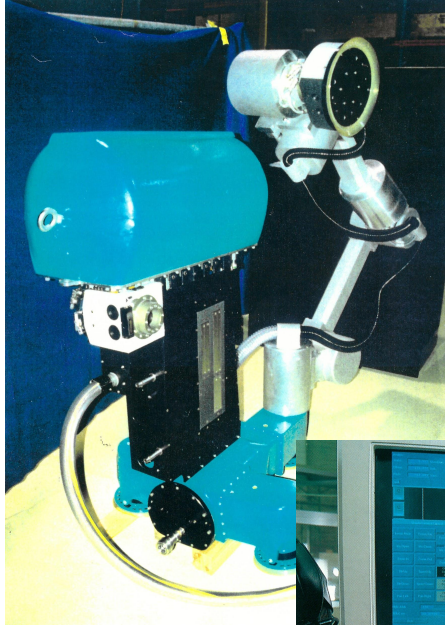


Brute force solution

- R - Theta - Z gantry
- Mounted directly to containment vessel
- 1 DOF tilting ultrasonic inspection head
- Passive compliant transducer mount
- Weighs 16 tons
- Three day installation and setup time
- Cerca 1972



URSULA



The software that remotely operates URSULA plays a crucial role in the overall effectiveness of the robot. Dave Mintz prepares to send a command to the tool located in the mockup.



- Neutrally buoyant
- 6 DOF Serial chain manipulator
- Suction cup stabilization
- Underwater autonomous tool change
- 9 transducer ultrasonic head for inspection
- Suction cup tool head for locomotion
- Ultrasonic range finder for localization
- SW based kinematic inspection control



Optimization and path planning



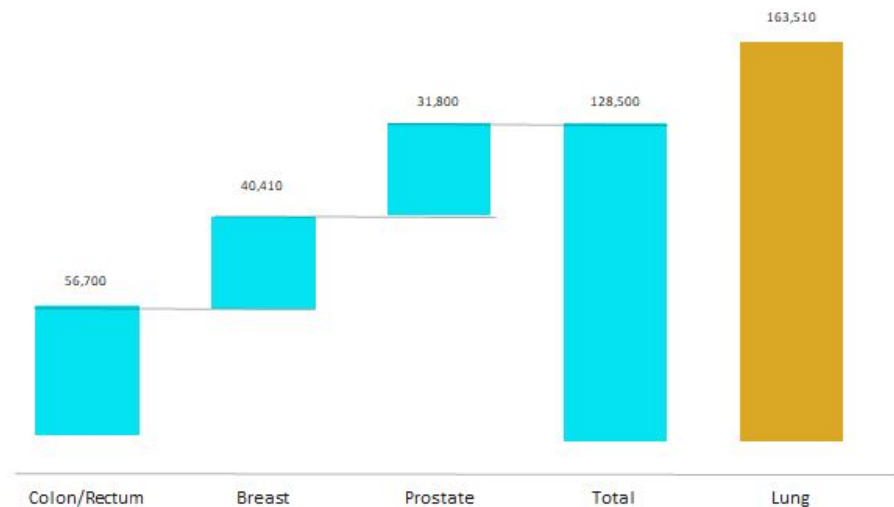
A photograph of surgeons in an operating room, wearing blue scrubs and masks, illuminated by overhead surgical lights. The image is dark and has a teal tint.

The Future of Lung Cancer and the Monarch™ Platform

AURIS™

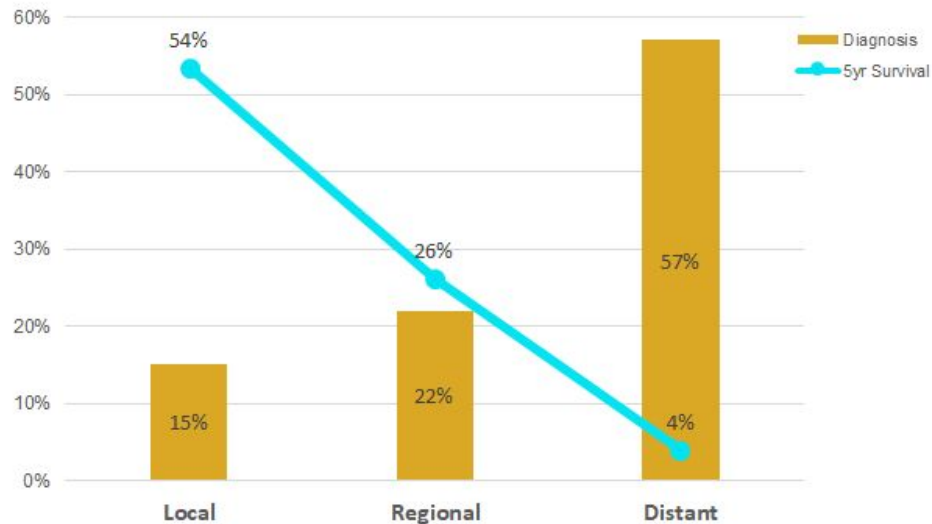
Why Lung Cancer?

U.S. Annual Cancer Deaths¹



- Population-based study; Gould et al estimate incidence of pulmonary nodules in the U.S. at 1.5 million each year
- 10-fold difference from prior reports

Late Stage Detection Impacts Survival Rates²



- 6% are diagnosed without enough information to indicate a stage

1. Gould M, Tang T, Liu I-LA, Lee J, Zheng C, Danforth KN, Kosco AE, Di Fiore JL, Suh DE. Recent trends in the identification of incidental pulmonary nodules. *Am J Respir Crit Care Med* 2015;192:1208-1214
2. <http://seer.cancer.gov/statfacts/html/lungb.htm>. SEER 18 2007-2013, All Races, Both Sexes by SEER Summary Stage 2000.

Shared Culture leads to Symbiosis between FRC + Auris

- Over ¼ of Auris Advanced Development employees are FIRST alumni
 - Auris employees mentor **7** unique FRC teams
 - **26** full time employees and **18** internships that had FRC involvement (total sum up to 2018)
 - **3** of the full time employees are previous interns!

- The FRC technical skills, design processes, and culture prepare students to succeed at companies like Auris.
 - rapid and continuous iteration
 - collective brainstorming
 - collaborative and cross functional teams

