

Transitioning Tech and People out of Academia

Future workforce development

Brian O'Neil

PT-3, Pit Technologies

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Problem definition

- LANL's national security mission
 - TA-55 is the nation's plutonium science and engineering center of excellence.
 - Must maintain a critical skill base of plutonium expertise across a *broad suite* of technical capabilities.
 - PF-4 is the nation's only operational pit facility.
 - Stockpile certification – systems will function as intended if called to do so.
- TA-55 workforce challenges
 - Subject matter experts are retiring rapidly.
 - University students not that interested in national security/weapons work.
 - Los Alamos is geographically isolated.
 - The security environment is unattractive.
 - In short: It is very difficult to recruit and retain the workforce we need to meet our missions today and into the future.

Approach - Instead of recruiting the workforce we need, we're building it.

- LANL
 - Fund graduate education
 - Fund undergraduate senior design projects
 - Collaborate on interesting graduate projects
 - Provide summer opportunities
 - Clear security hurdles early (I hate to say indoctrinate...)
- University of Texas
 - Recruit students likely to “stick”
 - Develop broad curriculum – nuclear engineering/robotics
 - Find research topics relevant to LANL's national security missions
 - Encourage students to work at the lab

Why Robotics?

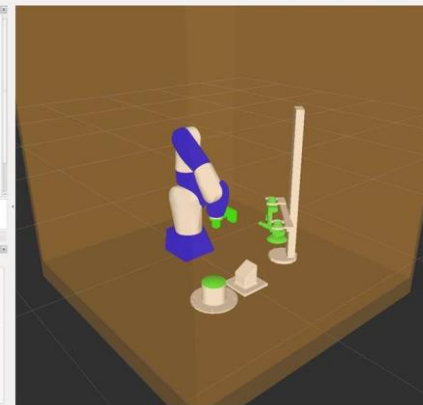
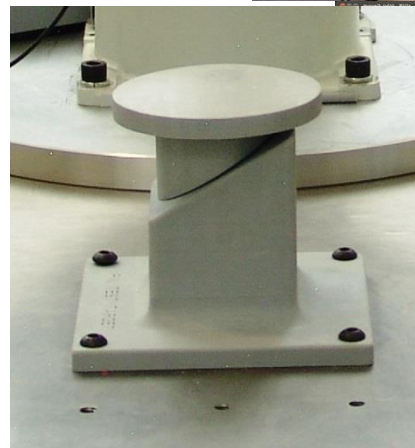
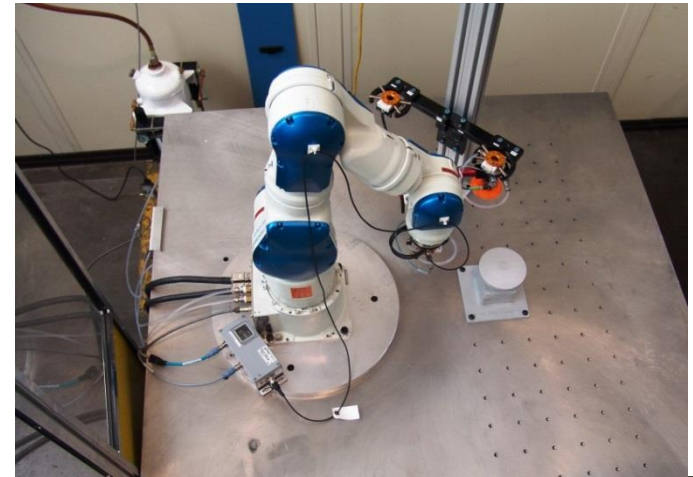
- Technology
 - Remove human “skill of craft” from manufacturing processes
 - Scalability
 - Flexibility with limited footprint
 - Decrease sensitivity to funding/staffing cycles
- People
 - Mechanical engineers – Metals, Materials, Mechanisms
 - Code savvy – Machine tools, PIC controllers, weld controllers
 - Mechatronics
 - Nuclear engineering
 - Willing to think outside the box and embrace change



Graduate Student Project Examples

Nuclear Assembly

- Automated, supervised SNM encapsulation
- Force feedback, compliant component assembly
- Relevant technologies demonstrated on representative components
- High consequence of failure – technology not robust enough



Hybrid Force/Position controlled Assembly, Brian O'Neil

Material Reduction

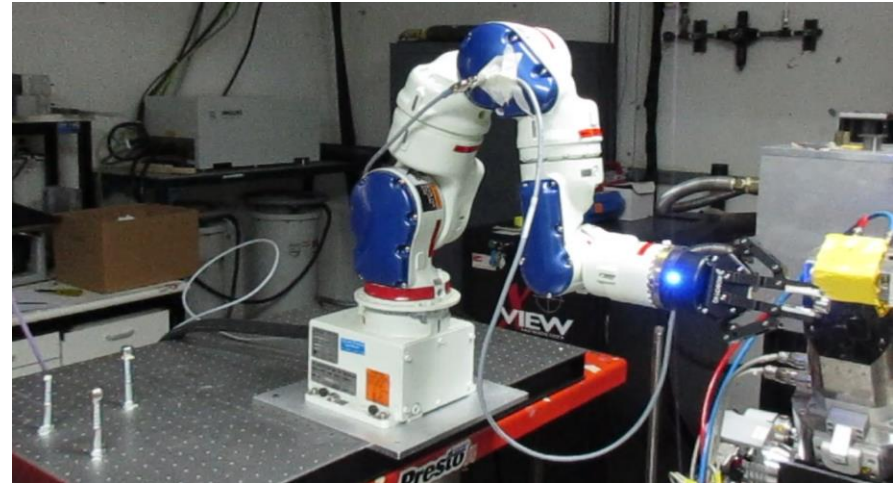
- Automated size reduction of hemishells
- Robot repeatedly positions component in a punch
- Relevant technology is mature
- Significant systems integration required
- Process is in use, but with no robot



**Material Reduction Demonstration,
Clinton Peterson**

Non Destructive Testing

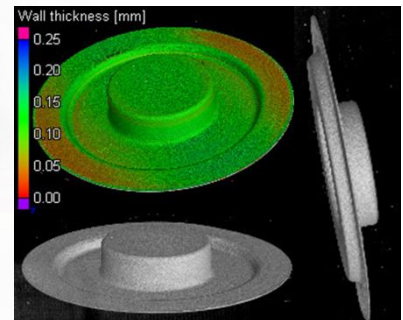
- Robotic positioning of components for Radiography/Tomography
- Reduce personnel dose, improve throughput
- Technology Mature
- Demonstrated on actual parts
- In development for plutonium manufacturing



Radiography Demo, Joseph Hashem

In situ metrology

- Perform Tomography on detonator cups for inspection.
- Replace labor intensive sectioning and measurement
- Underlying technology is mature
- Early in development



Cup Metrology, Adam Allevato and Nicolas Hashem

Contamination Monitoring

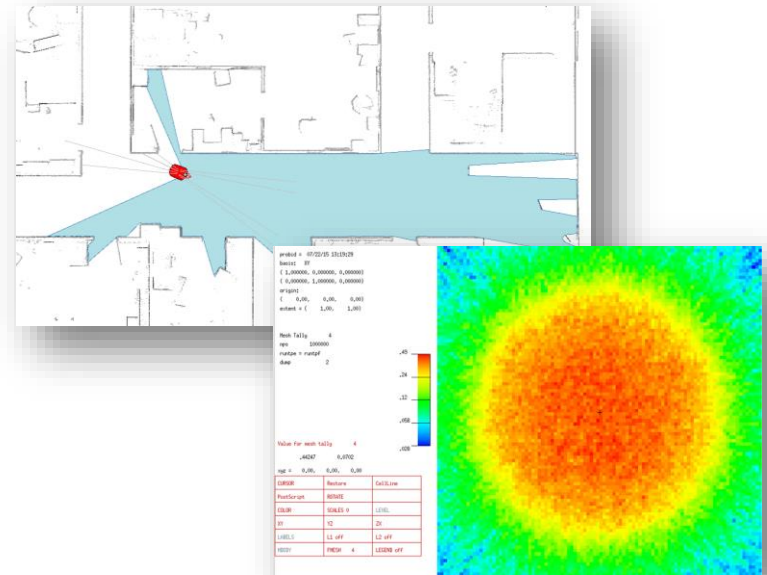
- Performs remote or routine contamination monitoring
- Operation during down time, augments RCT coverage
- Mobile robotic mapping and navigation is robust
- Difficult to implement without wireless connectivity



RoboRCT, Alex von Sternberg

Radiation Survey

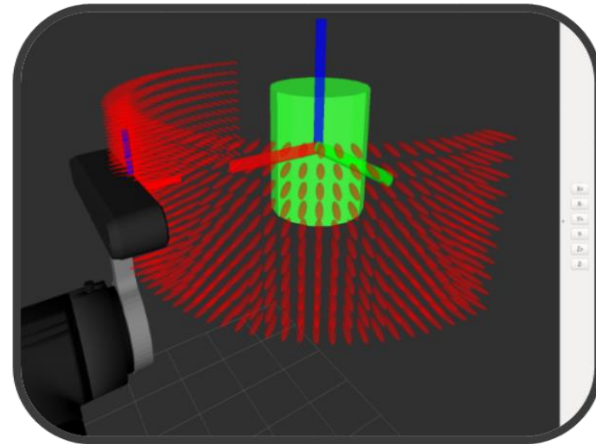
- Performs neutron/gamma survey
- Research underway to analyze rad effects on hardware
- Mobile robotic mapping and navigation is robust



Neutron dose mapping Cheryl Brabec

Vault Surveillance

- Perform visual or radiological inspection of an item
- Permits operator to control the sensor in a relevant reference frame
- Underlying technology under development, but risk is low



Non-contact task planning, Andrew Sharp

Impact at LANL

- 5 Ph.D. graduates – 3 working at LANL
- 4 Master's graduates – 3 working at LANL
- 6 students in the pipeline.
- Substantial portion of processes for manufacturing now owned/managed by graduates.
 - Size reduction
 - Laser Marking
 - Automated surface prep
 - Pit radiography/CT
 - RoboRCT
 - Automated welding – Laser, E-beam, GTA
- Graduates also involved in other missions at the lab
 - DFEAT
 - Subcritical experiments

Looking forward

- Difficult to predict what LANL's national security mission space will be in 30 years.
 - Threats are changing
 - Weapons are aging
 - Technology is advancing
 - Adversaries are investing
- We must build an agile and adaptive Army for the uncertain future
- We must also **build** an agile and adaptive civilian technical workforce and engage them in our national security missions.
 - Nuclear Stockpile Stewardship – Design, Manufacturing, Certification
 - Non-Proliferation
 - Threat response
- We compete for talent with Google, Facebook, Amazon, and academia.
- If we want to transition people out of academia, we must engage academia, and be deliberate in encouraging the transition.