



Accelerator Remote Handling Telerobotics

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Targets and Experimental Support Team
Accelerator Operations Technology

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LA-UR-22-22680

Background and legacy

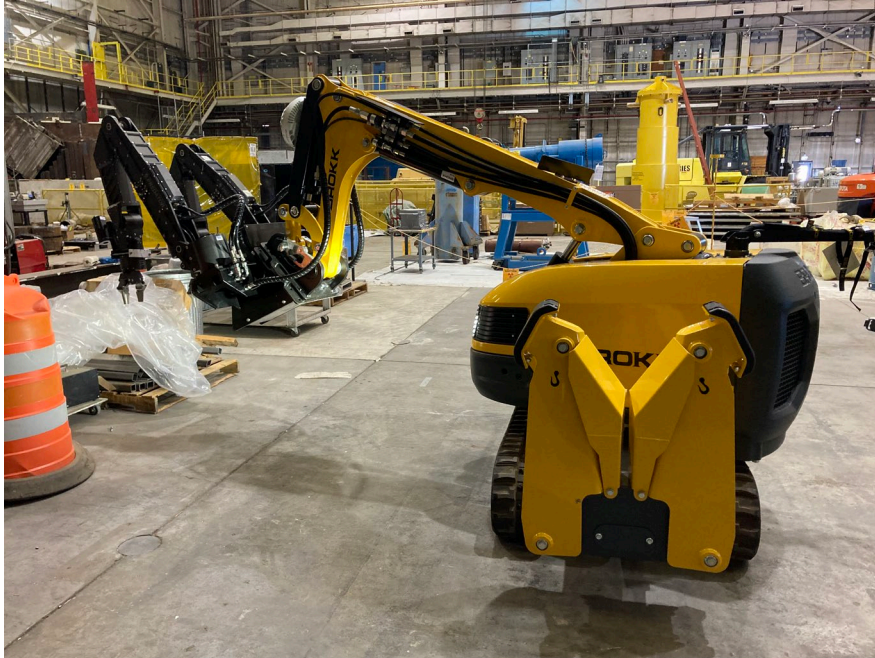
- Long legacy of remote handling operations
- Custom designed trailers for master control and remote viewing
- Telerobotic system had extension of 40ft to remotely work on targets.



System Requirements and Design

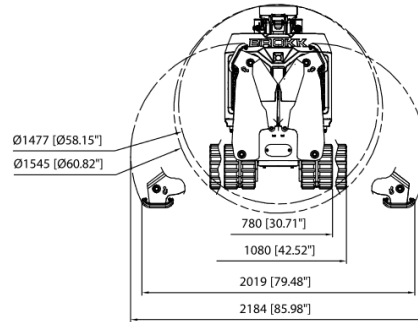
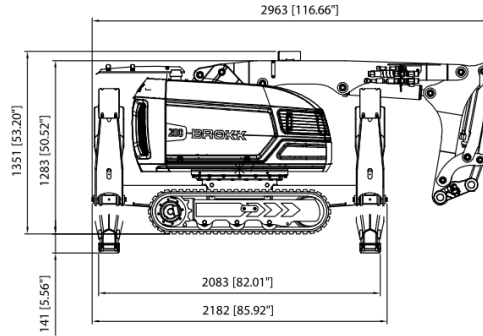
- Mobile
- Large reach ~20ft
- Two hand systems
- Large pickup weight, grip force
- Washable
- Adaptable platform
- Small package
- Easy to setup and use
- Easily incorporate into current team resources

Integrated system by Brokk and Kraft Telerobotics



Brokk

- Electro-hydraulic
- Detachable tools
- Narrow enough to enter wide doorways
- 2100 kg; 4630 lbs
- 480VAC



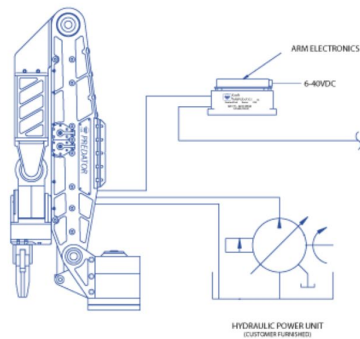
- Brutal demolition power
- Small footprint for its power and reach
- 27.5 kW Brokk SmartPower™ electrical system
- Built and optimized for heavy, high performance attachments



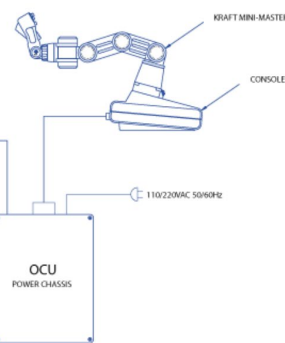
Predator Arms, Kraft Telerobotics

- Max lift 227kg (500lbs)
- Max lift at extension 91kg (200lbs)
- Wrist Torque 135Nm (100 ft-lbs)
- Grip force 1334N (300lbs)
- Programmable functions/motions
- Force feedback

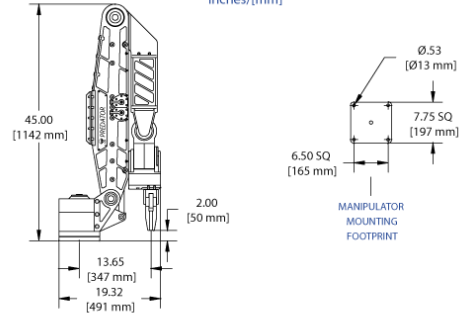
REMOTE MANIPULATOR ARM



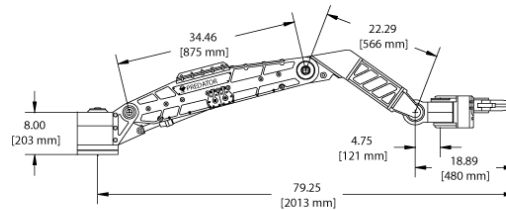
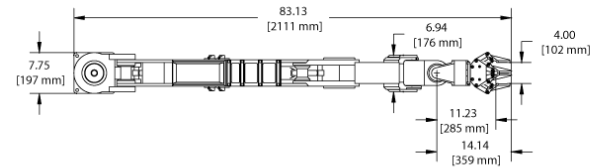
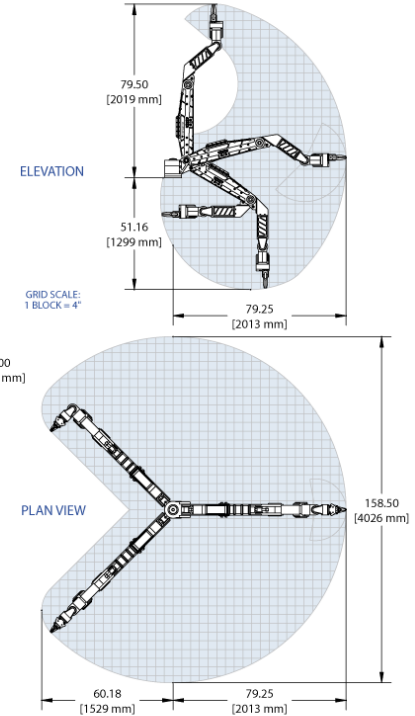
OPERATOR CONTROL UNIT



OUTLINE DRAWING
Inches/(mm)



PERFORMANCE ENVELOPE



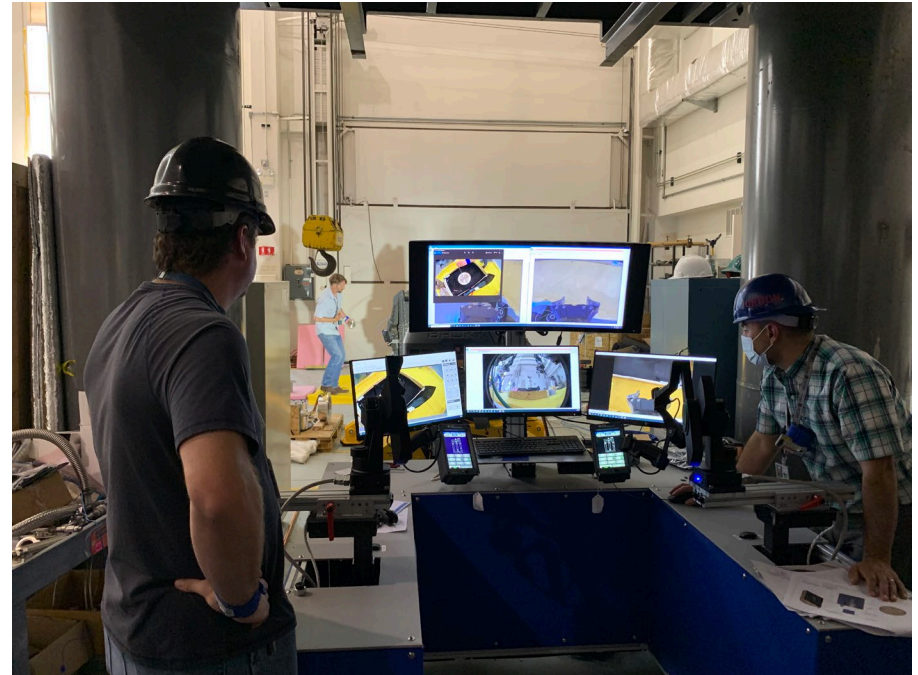
Cameras

- 2592 x 1944 resolution POE cameras
- 6 cameras on the brokk-predator system
- Multiple auxiliary cameras added as needed

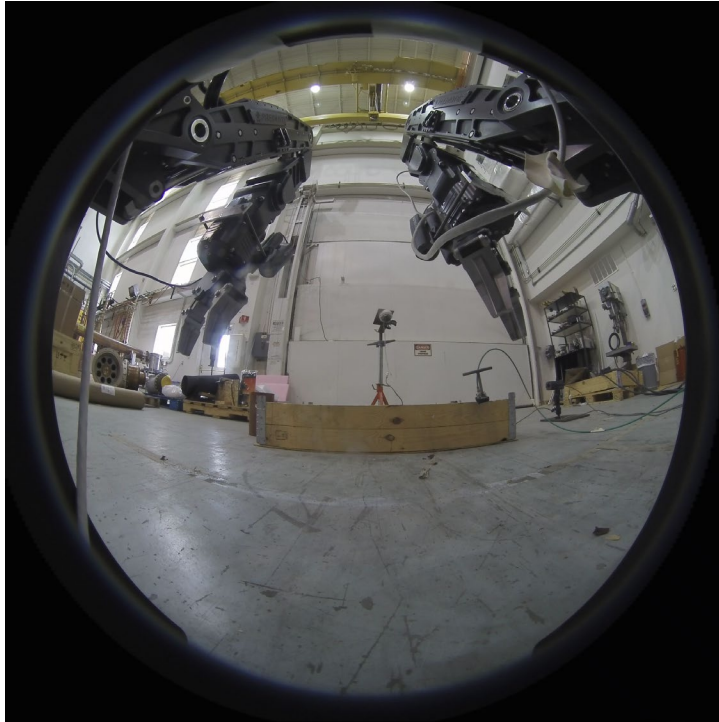


Viewing Station

- 4 monitors
- Adjustable monitor height
- Adjustable height and width of the master controller placement
- Mobile viewing station
- Stream and record multiple cameras at the same time



Camera Placement

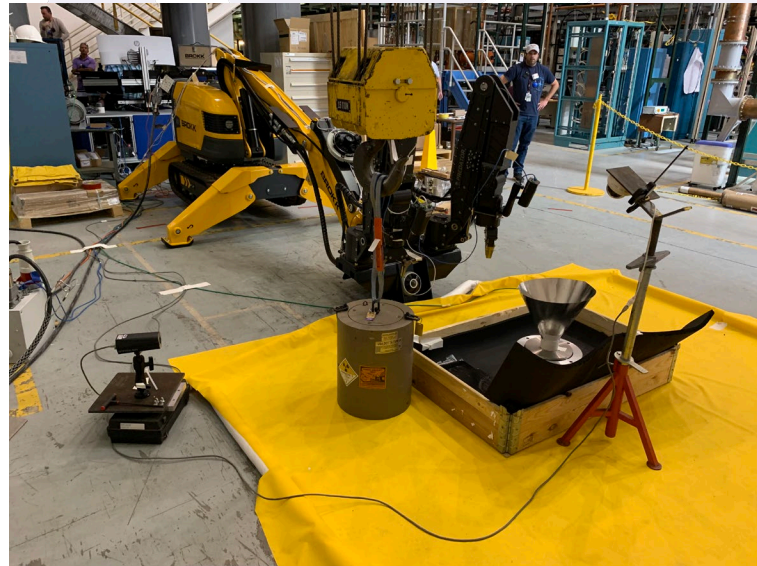


Trailer



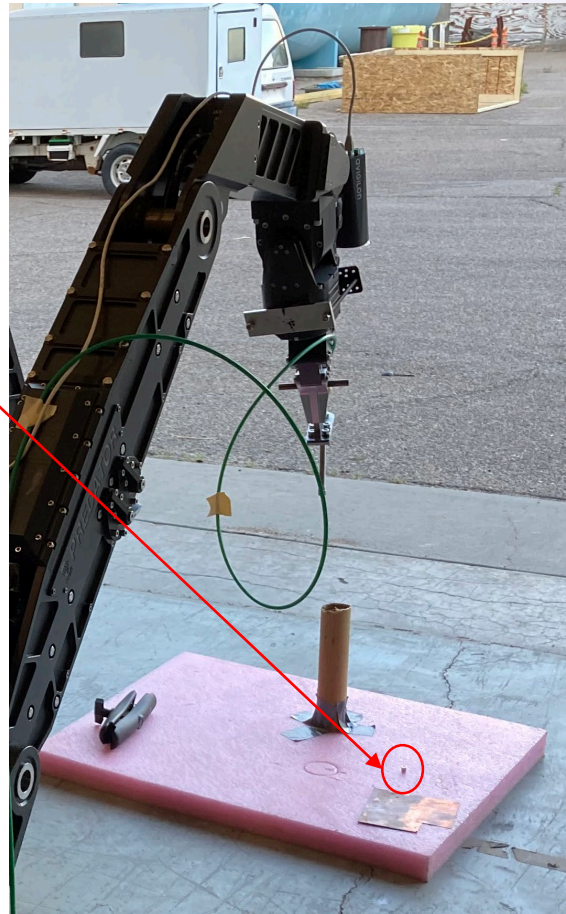
1 Ci Co-60 Source Transfer

- Transfer a source from its shipping cask to its experimental housing
- 150 mSv (15 Rem/hr) @ 30cm (~12in)
- 9.5mm (0.375in) diameter x 9.5mm (0.375in) tall cylinder



Suction tools

- Small enough to pick up objects as small as 6mm (0.25in)
- Multiple suction cups available



Beam Window Downsizing Setup

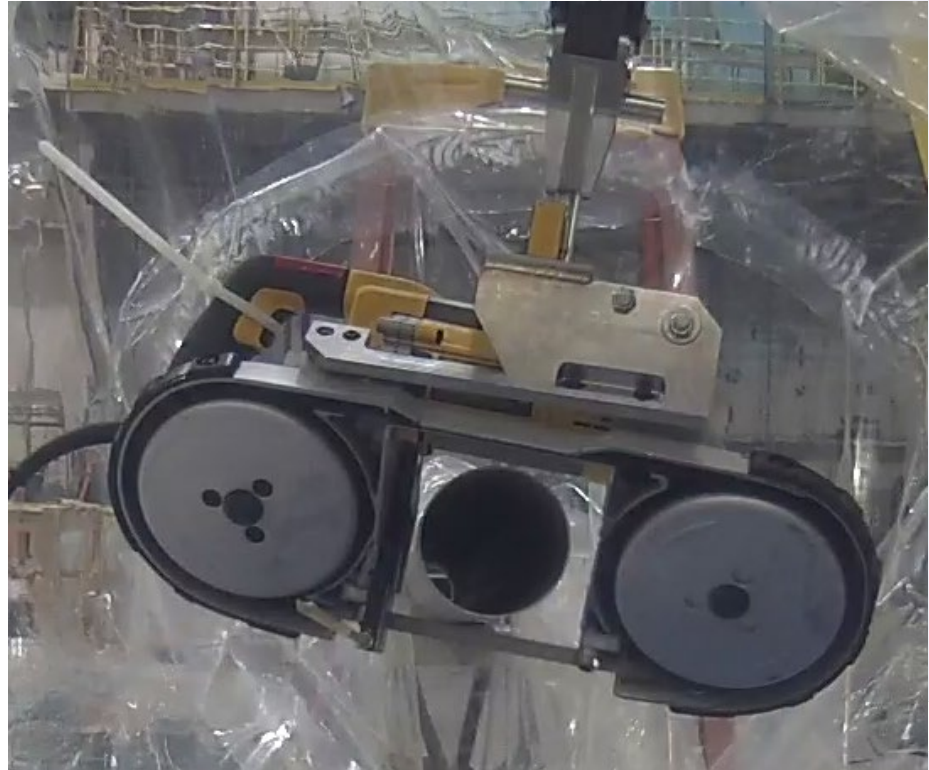


Mockups

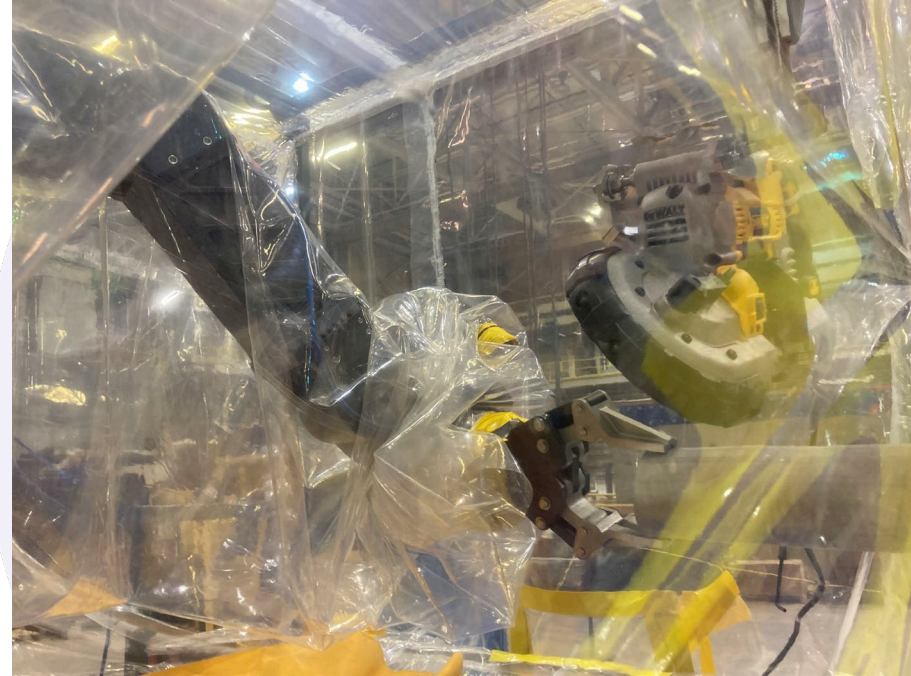


Saw Attachment

- Standard Dewalt portable saw with custom designed bracket with T-handle

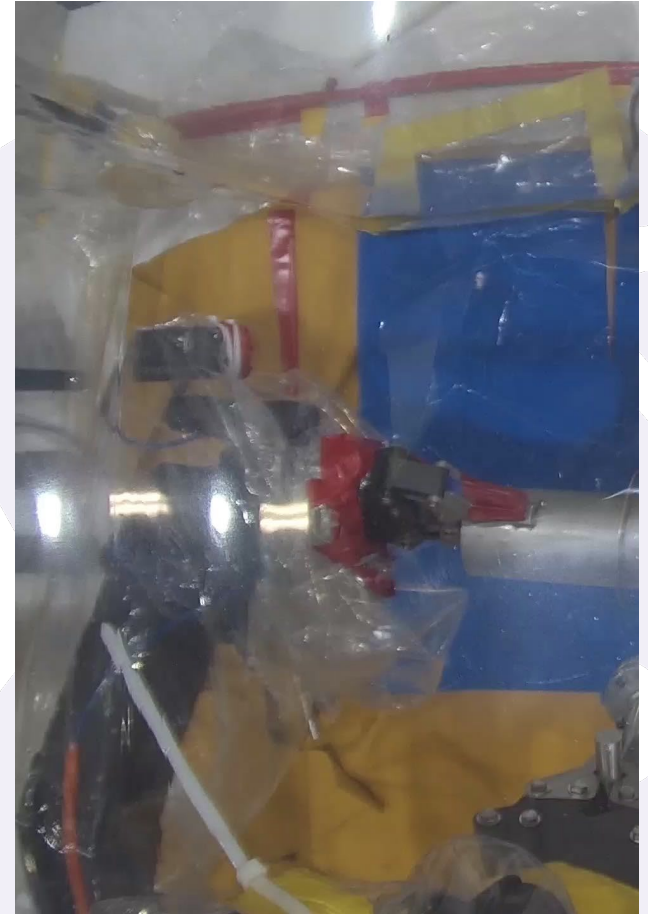


Cutting techniques



Decontamination materials

- Loctite rubberized coating
- Somewhat durable
- Easy to peel off



Challenges

- Live streaming with minimal latency
- Camera depth perception
- Contamination control and cleaning

Future work

- Remote handling rigging
- Improved cameras
- Resolve and improve camera latency
- Improve contamination control methodologies
- Additional tooling



Questions