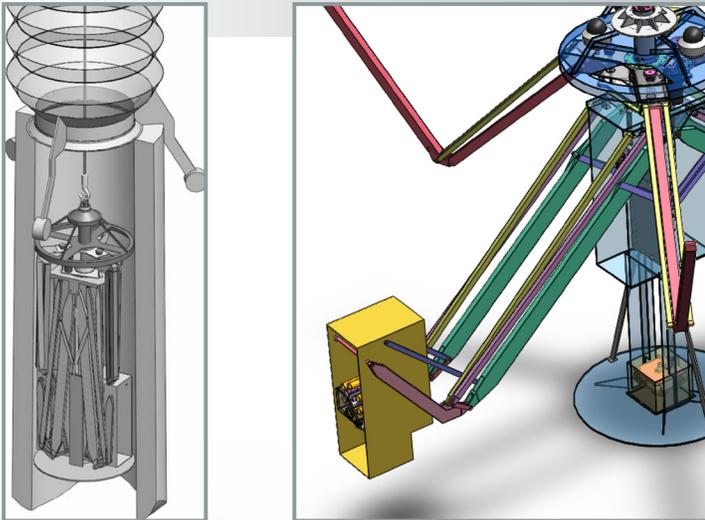


ORNL Robot Takes Pollutant Samples and Assesses Structural Integrity of Stacks before Demolition

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Technology Summary

Gas ventilation stacks must be inspected to take samples of contaminants and assess the structural integrity before the stacks can be dismantled. Until now this has been done by lowering workers into a stack on a rope, where they take samples of contaminants. ORNL researchers have developed a totally new concept—a remotely controlled robotic stack characterization system that is a safe, effective alternative method for appraising these giant stacks. The ORNL system is simple and inexpensive and can be used anywhere remote inspection of off-gas or exhaust stacks is needed.

Any potential pollutants that coat the inside of exhaust stacks must be sampled before strategies for demolition and waste disposal can be devised. The structural integrity of these giant chimneys, some of them hundreds of feet high, must also be assessed. The ORNL stack robot features instrument bays that hold the sampling equipment and sensors. It incorporates a bipod that deploys the instrument bays and a tripod that centers the system inside a stack. The stack's overall height, top and bottom inside diameters, and methods of construction can vary widely. The ORNL invention accommodates internal stack diameters from 5 to 22 feet. The design provides significant lateral stability for the instrument bays. This is critical for core drilling, which can initiate forces up to 100 pounds.

The new stack robot can be retracted to a small diameter for insertion into small stack openings and then expanded to bring the instrument bays close to the inside walls. There, a remotely operated, multisample core-drill and core-extraction system is positioned and activated to take multiple samples of pollutants from the concrete and/or brick liners of the stacks. A vacuum removes dust from the core bit during drilling. A wide range of core diameters and drilling depths is possible. When the robotic system is returned to ground, the samples can be readily removed from the core bits.

The system also features a remotely operated smear sampling system, which takes smear samples of any potential contaminants inside the stack using adhesive pads. These samples are then sent for analysis. Multiple samples can be taken before uploading. The device seals and protects the samples so that cross contamination is minimized among multiple samples. The system has a relatively low overall height, which simplifies stowage and transport.

Advantages

- First robotic system for stack entry and sampling
- Simple and inexpensive concept
- Determination of proper strategies for dismantling and safe disposal of pollutants before disassembly and removal of the stack by personnel
- Robotic core drilling and sample extraction
- Collection, sealing, and protection of multiple samples from cross contamination by automated smear sampling

Potential Applications

- Remediation technology for use anywhere remote inspection of off-gas exhaust stacks is needed

Patent

Application in preparation

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