

## FORERUNNER Steam Generator Manipulator

### Challenge

Steam Generators in PWR Nuclear Power Plants require periodic maintenance. One main task is the eddy current inspection of tubes to detect degradation and assess other important conditions of the component. The inspection involves literally thousands of tubes which are probed in quick succession. Due to radiological conditions and the dense array of tubes, the task is performed with robots to ensure safety and accuracy of the inspection.

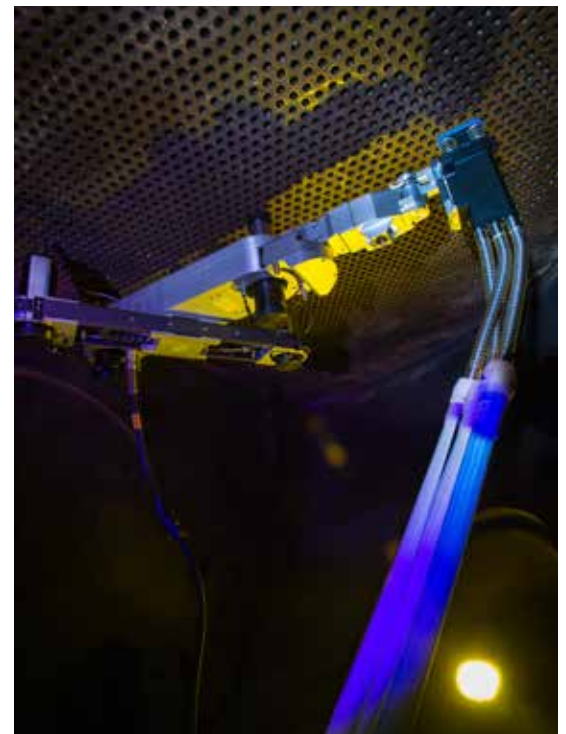
### Solution

In keeping with our history of providing state-of-the-art systems for nuclear power plant maintenance, Framatome has incorporated FORERUNNER as part of our suite of instruments, tools and software that are used to inspect and repair steam generators.

FORERUNNER is the newest manipulator for steam generator inspection and repair. Its size and design minimizes installation and inspection times by providing unlimited access to all the steam generator tubes. FORERUNNER is a light, mobile robot. Its coordinated movements in all working positions, on horizontal or vertical tubesheets, easily adapts to different steam generator geometries.

Installed and removed with a motorized carriage, the robot engages with the tubes and walks out using pneumatically actuated grippers with fail-safe logic. The entire process is managed remotely, via a single controller and cable, resulting in no human interface and a 30 percent reduction in dose.


Other performance improvements with FORERUNNER include its ability to calculate the optimal path using an intelligent algorithm. This will decrease inspection time considerably. Additionally, the device can reach more than 200 tubes in a given stance and multiple robots can be deployed for increased productivity. The FORERUNNER accommodates routine inspection and repair tools to support eddy current inspection, tube stabilization and plugging, as well as in-situ pressure testing.



### Customer benefits

- Considerable equipment reduction, a single controller and cable
- 80% reduction in installation time
- Dose reduction with improved installation time
- No exclusion zone or access limitations
- Optimized inspection path saves time
- Eliminates machine vision delays
- Compact design offers option for multiple manipulators to reduce schedule

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is **our** everyday **commitment**



**FORERUNNER** is a reliable, low-maintenance robot with safe, fast setup. With its fail-safe logic and the strongest grippers on the market it is developed to satisfy all regulatory requirements and give the best inspection results at the same time.

## Technical Information

- Dual independent encoders
- Integrated machine vision
- Fully automated optimal movement
- Power supply: 110-230 VAC, 50-60 Hz
- Air Supply: 72-116 PSI
- Operating voltage: 48 V
- Total weight: 39.7 lb.
- Water and dust protection to IP66 class
- Pneumatically actuated grippers with total loading force 4x1700 N at 72.5 PSI
- Self-leveling function to ensure continuous contact with the tubesheet

## Features

- A single manipulator with one operator and one cable
- Position verification with independent on-board systems
- Auxiliary axis reaches more than 200 tubes without moving
- Multiple robotic tools on a single manipulator
- Maintains contact with tubesheet even during air or power loss
- Gripper unlock fail-safe
- Pneumatically actuated grippers ensure no damage to the tube or tubesheet
- Adapable to any tubesheet geometry
- Precision tube alignment
- Instant inspection guidetube sealing
- No human interface required for tubesheet inspection

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