



UNC CHARLOTTE

The WILLIAM STATES LEE COLLEGE of ENGINEERING

Senior Design Project Description

Company Name	EPRI	Date Submitted	4/8/2018
Project Title	Design of ROV for Spent Fuel Pool NDE Sensor Delivery (EPRI_POOL)	Planned Starting Semester	Fall 2018

Personnel

Typical teams will have 4-6 students, with engineering disciplines assigned based on the anticipated Scope of the Project. 250 hours are expected per person.

Complete the following table if this information is known, otherwise the Senior Design Committee will develop based on the project scope:

Discipline	Number	Discipline	Number
Mechanical	4	Electrical	1
Computer		Systems	
Other ()			

Company and Project Overview:

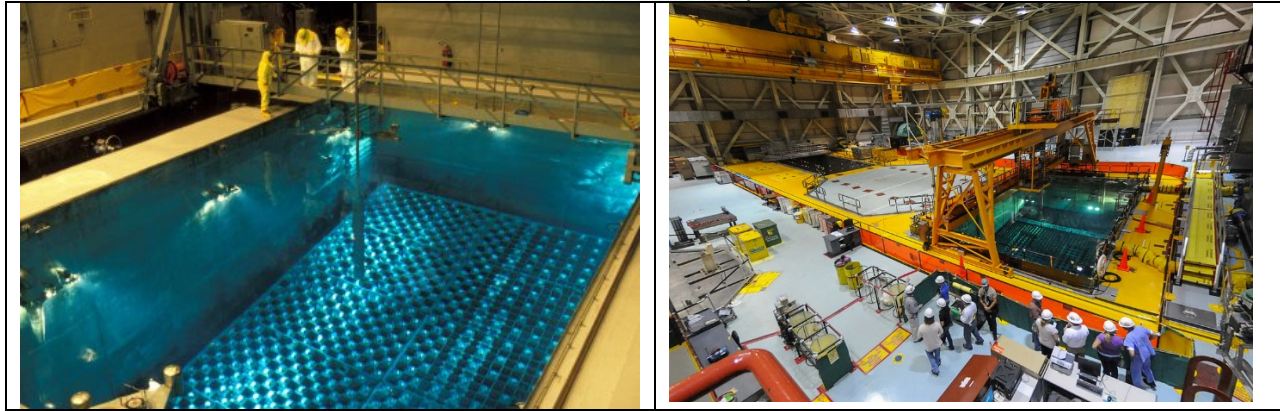
The Electric Power Research Institute (EPRI) conducts research, development, and demonstration projects for the benefit of the public in the United States and internationally. As an independent, nonprofit organization for public interest energy and environmental research, we focus on electricity generation, delivery, and use in collaboration with the electricity sector, its stakeholders and others to enhance the quality of life by making electric power safe, reliable, affordable, and environmentally responsible.

Leakage from fuel pools is a common issue in the nuclear power industry, with some plants experiencing leakage since early in plant life. Plant owners need to identify and address leaks from their fuel pool liners but it is difficult to implement inspection tools due to the harsh radiation (expected at approximately 10,000 r/hr) and high temperature environment (up to 120⁰F). The eddy current array (ECA) sensor is identified. However, a delivery system is required to transport the eddy current to these hard-to-reach and harsh environment locations.



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Therefore, the goal of this project is to develop a conceptual design of remotely operated underwater vehicle (ROV) for spent fuel pool liner inspection. The ROV would be tethered. The ROV should be able to payload the eddy current sensor, camera and lighting in order to access and navigate the vertical liner and space between the floor of the spent fuel pool and fuel racks. This project will not fabricate any ROV's but build 3D models and assess the feasibility and applicability to achieve the desired goal.

Project Requirements:

This project would design a ROV using 3D models that can be operated underwater and radiation environment. The requirements of this project are:

- The modelled ROV shall be capable of operating at up to 13 m deep underwater and shall be watertight for all electrical and electronic components of the entire system.
- The height of ROV model shall not exceed 8 inch (20.3 cm) to navigate between spent fuel pool floor and fuel rack.
- The ROV model shall have sufficient movement with free moving axis to navigate, forward (x), backward (-x), right shifting(y), left shifting (-y) directions and turning in order to get the ECA, camera and lighting to the desired test location. Therefore, the ROV should be able to payload the ECA probe, camera, light and cable loads and be able to climb vertical walls while providing ease of navigation features. The purpose of the camera and light is to show the location of the ROV underwater.
- The ECA probe needs to come in contact with the test surface to commence scanning of the spent fuel pool liner plate. Therefore, it is important that the ROV design incorporate a back force air pressure to the ECA probe housing in order to achieve the required contact of the probe surface to the test plate surface.
- In order not to damage any electronic parts of the ROV, radiation shielding must be considered in the design.
- The ROV shall be designed in such a way that no parts become loose and drop-off during its operation. All parts must be accounted for before the go into the pool and upon withdrawal.
- The power to the ROV shall be supplied from an outside source. The ROV shall be easily retracted when the power is lost.



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- The ROV shall have swimming and floating capabilities in water and must be able to swim from the pool surface to bottom of the pool and vice versa.
- Build 3D CAD modeling and generate movie clips showing the operability.

Suggest estimated manufacturing cost and bill of materials (BOM)

Expected Deliverables/Results:

- Final Report that includes all of the above items
- A simplified demo or base platform to demonstrate proof of concept

Disposition of Deliverables at the End of the Project:

Report delivered to EPRI at end of project

List here any specific skills, requirements, knowledge needed or suggested (If none please state none):

- None