INDUSTRIAL SOLUTIONS LABORATORY

Company Information

Company Name	*Framatome Inc.*	**Date Submitted**	*11/4/2022*
Project Title	*In-Pipe Cleaning and Surface Preparation Development and Optimization (FRAM_CLEAN)*	**Planned Starting Semester**	*Spring 2023*

Senior Design Project Description

Personnel

Typical teams will have 4-6 students, with engineering disciplines assigned based on the anticipated Scope of the Project.

Please provide your estimate of staffing in the below table. The Senior Design Committee will adjust as appropriate based on scope and discipline skills.

Discipline	Number	Discipline	Number
Mechanical	3	Electrical	2
Computer		Systems	
Other ( )			

Company and Project Overview:

Framatome is a provider of innovative solutions to the commercial nuclear power generation industry. This includes addressing significant challenges that nuclear power plants face, such as degradation of buried and underground piping. Framatome has jointly developed a turnkey underground piping rehabilitation solution based on the application of a Spray In Place (SIP) liner applied to the inner diameter of the pipe system. This solution can rehabilitate (in place) existing underground small and large bore service water piping to extend the operability of these assets, without having to incur the extremely costly efforts associated with excavating and replacing underground piping. To support this solution, the envisioned UNCC senior design project primarily focuses on expanding on the previous UNCC senior design project Spring 2022 - FRAM_CRAWLER project and Framatome's internal developments to further research in-pipe surface preparation methods and develop an optimized approach or approaches that can integrate with Framatome's

current in-pipe crawler platform. The goal of the design is to efficiently clean the interior of buried piping to allow for the installation of Framatome's spray-in-place liner system.

The application of Framatome's SIP liner system within underground piping requires use of numerous tooling and equipment, all of which must be capable of integrating with an in-pipe crawler. This crawler will be used to position tooling within piping and assist in tooling movement. Integration of this in-pipe crawler and the surface preparation tooling is critical to efficient execution of the in-pipe liner system and is the focus of this project.

Below are images of some of the in-pipe tooling to be used for liner application.

Figure 1: Spin Cast Skid – Liner Application

Figure 2: Abrasive Blasting Skid – Pipe Cleaning

Figure 3: In-Pipe Visual Inspection

Project Requirements:

Specifically, Framatome is working on a spray in place liner delivery system, which includes the in-pipe crawler platform, spin cast liner application tooling, surface preparation tooling, inspection tooling, and associated umbilicals and outside the pipe equipment. The primary robotic/crawler system is being developed outside of the scope of this UNC Charlotte project and its design will be provided as input to the senior design team. The objective for the senior design team is to work from the Framatome provided input, including current in-pipe crawler design and liner application process with required surface preparation and focus on the integration of efficient surface preparation devices, which may be associated with abrasive blasting, ultra-high-pressure water jetting, laser ablation, or other means, onto the in-pipe crawler.

In addition, the senior design team shall consider the needs and design of any umbilicals that must be connected to the in-pipe crawler to support pipe surface preparation. This may be umbilicals that carry air/abrasive media/water and/or power and controls to support the developed surface preparation end effector.

The scope of this project will be to:

1) Develop an understanding of Framatome's buried and underground pipe rehabilitation solution, including the surface cleaning and preparation requirements.

2) Research various proven and/or new innovative in-pipe surface preparation methods and technologies and determine the most efficient of these to use with the liner application. Note there may be multiple surface preparation methods and technologies that may be useful depending on the liner being installed and piping configuration.

3) Design the interface between the in-pipe crawler platform and the surface preparation end effectors. This may include design modifications to the current skids and/or crawler.

Specifications associated with the in-pipe crawler, tooling, and liner application process will be shared at start of project.

Expected Deliverables/Results:

- Bullet list of all deliverables that the team is to provide to the supporter at the end of the project. Be specific here to avoid misunderstandings.

    - Evaluation of various surface preparation methods with basis for option(s) chosen
    - Drawings of crawler-tooling integration design
    - Calculations associated with crawler-tooling integration design
    - Prototype of integration design (Framatome to provide crawler)

Disposition of Deliverables at the End of the Project:

Students are graded based on their display and presentation of their team's work product. It is mandatory that they exhibit at the Expo, so if the work product was tested at the supporter's location, it must be returned to campus for the Expo. After the expo, the team and supporter should arrange the handover of the work product to the industry supporter. This handover must be concluded within 7 days of the Expo.

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

This project is expected to require coordination of Mechanical and Electrical Students should have good machine design skills / knowledge.