

## UNC Charlotte – Lee College of Engineering Senior Design Program

### Senior Design Project Description

|                      |   |                                  |                   |
|----------------------|---|----------------------------------|-------------------|
| <b>Company Name</b>  | <i>Siemens Energy, Inc</i>  | <b>Date Submitted</b>            | <i>12/03/2019</i> |
| <b>Project Title</b> | <i>Design/Build of a Portable Large Stud Removal and Minor Machining Operations Machine for Steam Turbine Casings</i><br><b>(SIEM_STUD)</b> | <b>Planned Starting Semester</b> | Spring 2020       |

#### 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:

| <b>Discipline</b> | <b>Number</b> | <b>Discipline</b> | <b>Number</b> |
|-------------------|---------------|-------------------|---------------|
| Mechanical        | 4             | Electrical        |               |
| Computer          |               | Systems           |               |
| Other ( )         |               |                   |               |

#### Company and Project Overview:

The Siemens Charlotte Energy Hub is the company's worldwide hub for 60 Hz power generating equipment. Opened in 1969, the facility has manufactured and serviced generators and steam turbines for the power generation market for decades. In November 2011, the facility celebrated the opening of a new expansion, adding gas turbine production and service capabilities. The new Gas Turbine facility was designed based on LEAN manufacturing principles and certified for U.S. LEED Gold green building standards, making it the most advanced gas turbine production plant in operation. The expansion represents a \$350 million total investment in Charlotte, adding 1,000 jobs. With its current workforce of 1,500 and more than one million square feet of space under roof, Siemens Energy in Charlotte has become the largest manufacturer in the city and the second largest among the 250+ Energy companies based in Charlotte.

This Project is sponsored by the Steam Turbine Division, Stationary Components of Siemens here at Charlotte, NC. This project will involve making a portable machine that can be mounted to a range of steam turbine casings to accurately remove any broken stud bolts from the casing or to machine some minor features into the casing.

#### Project Requirements:



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Siemens Steam Turbine Division manufactures new turbines as well as services older turbines. The amount of service work is growing very quickly and more efficient methods of getting product serviced are needed.

It is common that when the casings of turbines get pulled apart after 10-20 years in service, that a few of the studs are damaged or break. Some can be removed non-destructively but most broken studs need to be drilled/milled out. With the amount of work flowing the shop, this can tie up highly valued HBM equipment and can even result in work being turned down due to capacity concerns.

This machine will allow Siemens mechanics on the floor to remove broken studs ~~in~~ from the casing or perform minor machining operations without transporting and setting it up on an HBM machine, resulting in reduced setup time and increased capacity for additional machining work.

This machine will need to be adjustable for a range of casing sizes and will need to be able to accurately position relative to features on the casing. This machine will also need to be able to be mounted in vertical or horizontal states and be safely lifted using Siemens current cranes and rigging equipment. The machine also needs to be compliant with existing lifting procedures and OSHA requirements.

#### **Expected Deliverables/Results:**

- Operational “Portable, Large Stud Removal and Minor Machining Operations” Machine.
  - A complete set of prints for each component.
  - A complete set of CAD models for the machine.
  - A complete user and safety manual for the machine.
  - Safety evaluation according to Siemens’ and OSHA requirements
  - Recommended maintenance procedures.

#### **Disposition of Deliverables at the End of the Project:**

Machine, models, and manual to be given to the Supporter after the conclusion of the Expo.

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

- Mechanical Design
- Knowledge of Advanced Machining Processes
- Knowledge of engineering calculations (i.e. Stress, Machining Forces, Deflection, etc.)
- Knowledge of applicable safety requirements (Siemens & OSHA)