# Semi-Automatic Stud Welding Gun for Capacitor Discharge Stud Welding

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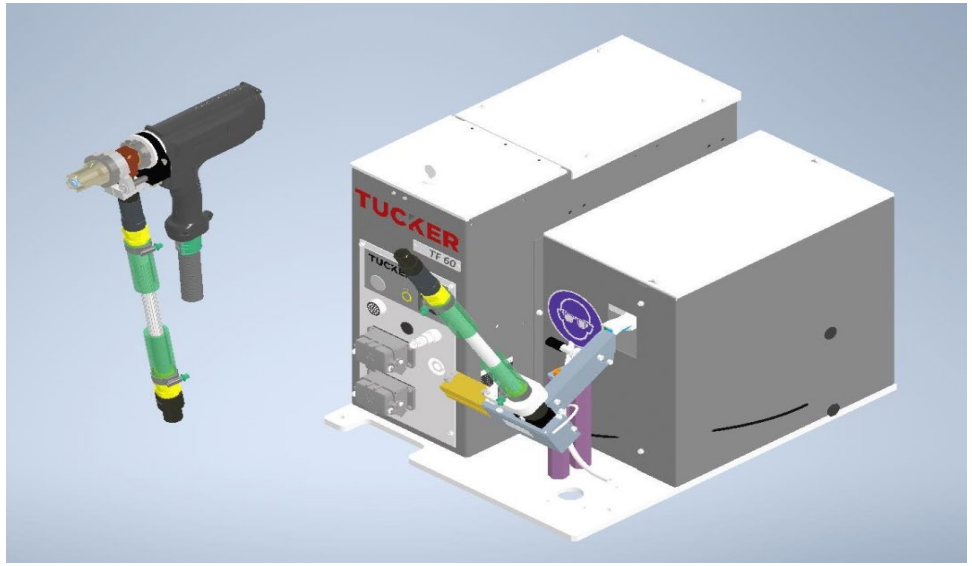
NATIONAL SHIPBUILDING RESEARCH PROGRAM™
Taking Shipbuilding and Repair to the Next Level

# Proposed Project

- Hand held Capacitor Discharge (CD) Stud Welding systems are used to install millions of ¼" diameter and smaller CD studs to attach insulation and small components to bulkheads and decks on ships.
- Studs are manually loaded into the gun prior to being shot.
- This project is focused on designing and developing a prototype semi-automatic stud welding system.
- Team Members
  - Newport News Shipbuilding- Jon Sweeney, Dan Moniak , Scott Grove , Elmer Dickens
  - Nelson Stud Welding- Nick Caratelli, Doug Phillips
  - Electric Boat- Vince Mangino
  - Ingalls Shipbuilding- Kevin Roossinck

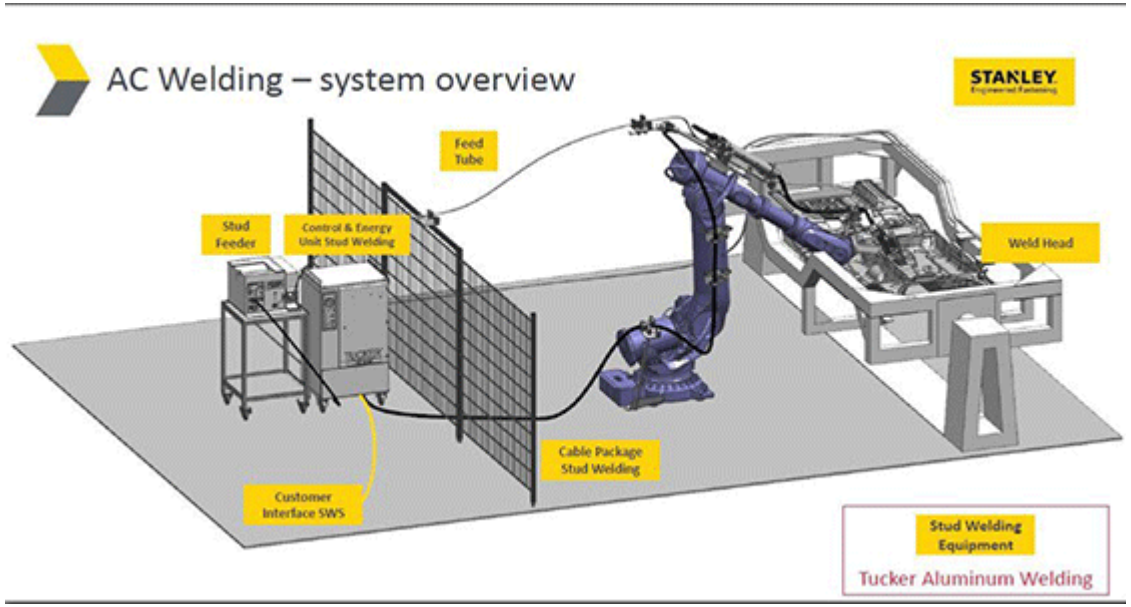
# Project Objective

- To design, develop and test a prototype semi-automatic CD or drawn arc (DA) stud gun that is capable of housing and loading multiple studs without requiring operator intervention, utilizing a battery operated power source that is man portable .



# Current Similar Technology

The stud welding industry has auto fed stud guns/loading systems that are well suited for assembly line work.



# Project Tasks

- Task 1-Team Members develop design concept for semi-automatic CD or DA stud gun, including loading system(ECD 8/1/2025)
- Task 2- Nelson Stud Welding to develop a prototype system at their facility (ECD Oct 2025)
- Task 3- Nelson Stud Welding to perform welding testing to validate system meets NNS needs and specification requirements, including DT and NDT (ECD Oct 2025)
- Task 4- Nelson Stud Welding to demonstrate systems capabilities for project team at their facility (ECD TBD)
- Task 5- Identify any required modifications to prototype system and report to Nelson Stud Welding (ECD TBD)
- Task 6- Shipyard demonstration of prototype system at NNS facility (location TBD)
- Task 7- Discuss tentative implantation plan for shipyards
- Task 8- Develop operator training plan and materials
- Task 9- Present final report, with recommendations, to NSRP Panel membership

# Project Kick-off

- Kick of meeting 5/19/2025
- Discussion:
  - Equipment, need for battery powered equipment vs plugging into ships power.
  - Process, CD vs short cycle drawn arc stud welding
  - Environment of application, need for robust equipment, and ability to break down light enough for 2 people or less to carry each component.
  - Agreed that a demonstration of the short cycle drawn arc stud welding process was needed.

# Short Cycle Stud Welding

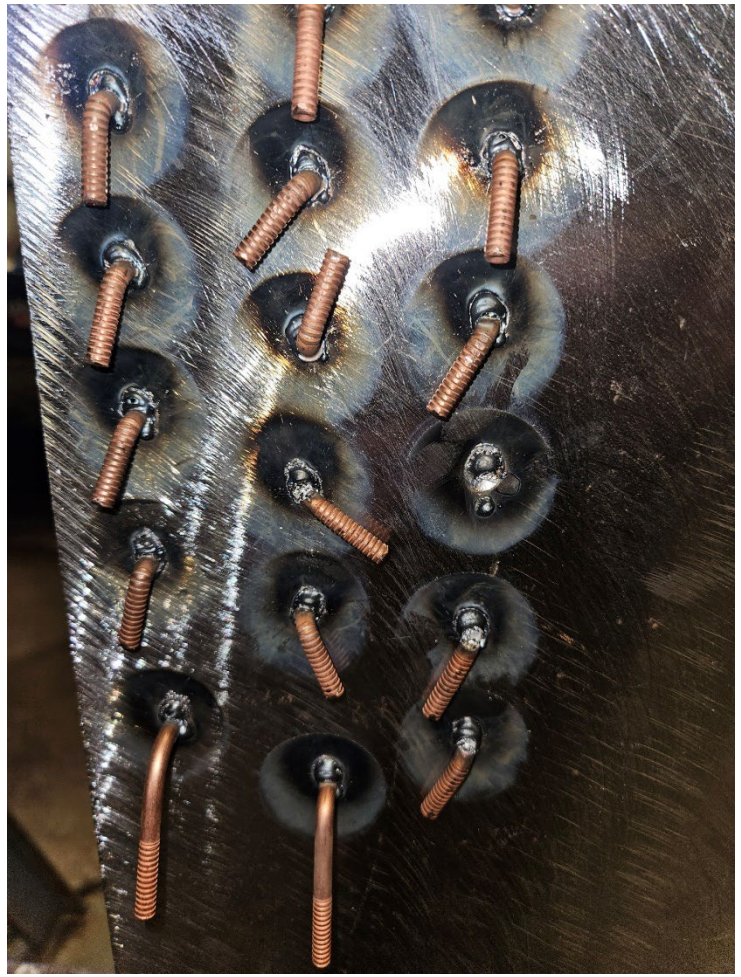
- Drawn arc stud welding process
- Uses high Amps and low time
- No ferrules
- Can be done with a standard stud gun, would be more controlled with a servo controlled stud gun

# Short Cycle Demonstration

- 6/19/2025
- Nelson demonstrated the Short cycle stud welding process at Newport News Shipbuilding
- Materials: 1” 11-HY80 plate, 3/16” 01-CS CD pin studs.
- Equipment: shipyard provided Nelson N900b battery powered welder, 25’ 2/0 gun and cable, with a 10’ ground.
- Special Equipment: Nelson brought a foot and pin holder.
- Settings demonstrated: 550-600A 0.07-0.08 seconds

# Demonstration results

- 21 studs were shot,
- Penetration is superior to CD
- Most of the studs were able to be bent to 90°
- Visual Inspection: the flashing was not consistent, there were signs of gouging or separation after bending of the studs.
- Further evaluation of the process will be needed to ensure the process meets Navy requirements



# Proposed Prototype/Next Steps

- Nelson to develop battery powered feeder, that is light weight, and portable.
- Integrate the feeder to work with a servo gun and a N900B battery powered stud welding machine.
- Perform welding testing to validate system meets NNS needs and specification requirements, including DT and NDT (ECD Oct 2025).
- Nelson to provide Recommended settings for Short Cycle welding of the attachment studs for NNS to evaluate and test the Prototype system with.

# NSRP AF Insulation Pin Welder

**Engineer Manager: Jonathon MacDougall**

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## Project Details

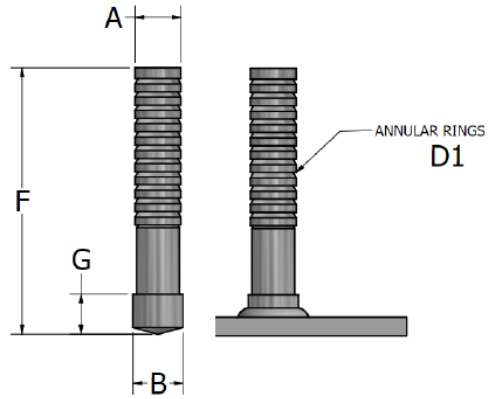
**N900b**


- Project id: ???
- BU: SEF Industrial
- Portfolio: Global Equipment - NSW
- Project Class: 4
- ESG / EV applicability: N/A
- MFG site: Liberty Court
- Prototype Testing (MS3): Oct 2025
- Launch Date (MS8): July 2026

## Key Application

- **Target Market:** Ship Building and Ship Repair at Newport News
- **Target Application:** Annular Pins 3/16 x 7/8”and 1-7/8”

N3A Navy pins are welded for the attachment of insulation. The insulation is impaled over the welded studs and retained with caps that are driven onto the studs, and lock onto the annular rings. The 5/16” diameter welded end on Nelson N3A pins permits welding without the use of inert gas shielding, which is normally required when welding aluminum studs.
The flat top caps for use with N3A studs are usually supplied in aluminum. They can also be supplied in plated mild steel or stainless steel, per the N3P Annular Ring stud.




## Features & Benefits

**Features:**

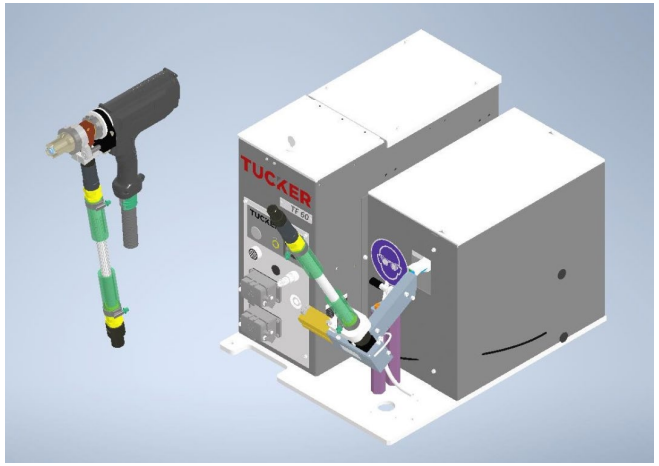
- Lightweight and Portable
- Battery Power
- Preset Weld Setting
- Process Monitoring
- Servo Drive capability for TGX-S tool
- LCD Scrolling for Messaging

**Benefits:**

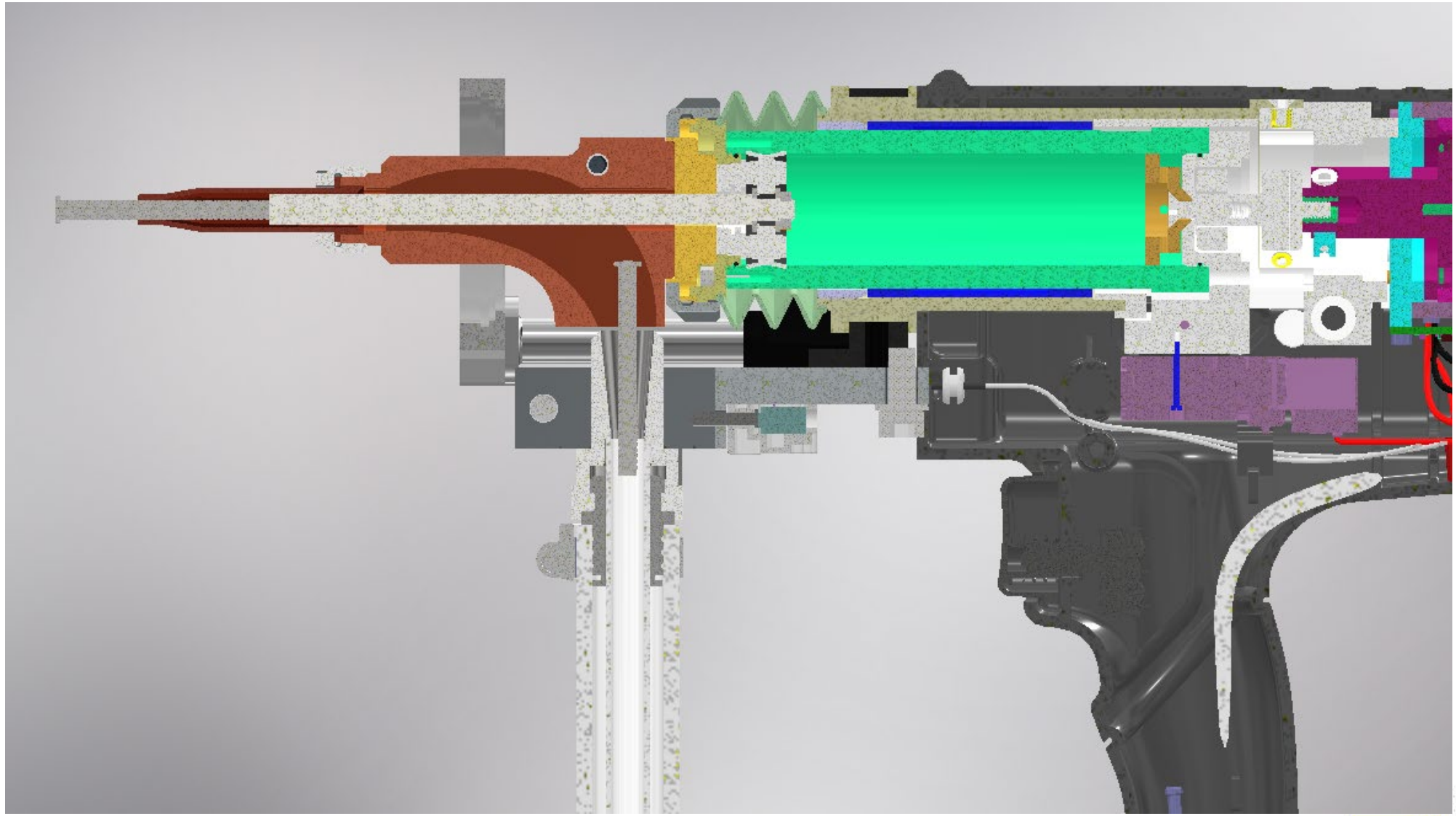
- Portable Feeder that can be easily moved into a work area and then will blow feed pins to an Auto Feed Handgun
- Feeder Gun configuration should be able to weld a minimum 20 studs/minute
- 80 PSI compressed air required for the blow feed operation
- Single Outlet configuration includes one Welder, one Feeder, and one Weldgun on 6M cable set

## Feeder and Gun Configurations

Handgun
Feeder
Feedtube



Stud is oriented with the feeding unit into the escapement device that shuttles the stud over an airport that blows the stud thru the feed tube into the gun escapement (shown in diagram) where it is held in position in the chuck for welding, after welding the cycle repeats



# Project Budget

- Project budget: $200,000.00
  - NNS: $49,805.00.00
  - Nelson: $150,000.00
- Spent to date:
  - NNS: ~$8500.00
  - Nelson~$15,000.00

# Questions or Comments?