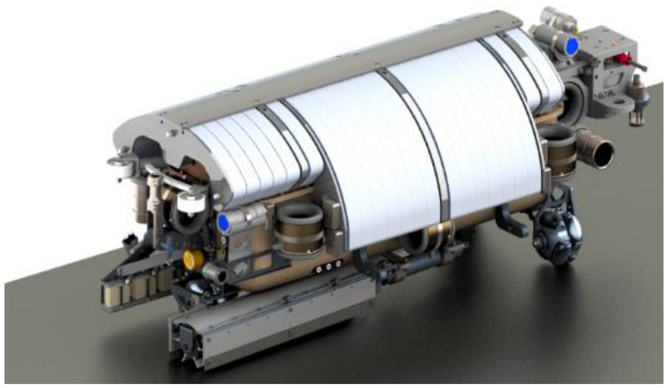
## Introduction

Square Robot, Inc. is a robotics technology company based in Marlborough, Massachusetts with a service and training facility located in Houston, Texas. Square Robot works directly with tank asset operators and also provides its services through partners in a variety of global locations to provide API 653, API 575, and EEMUA 159 certified inspections of above ground storage tanks (AST).

## Table of Contents

# Company and Technology Overview



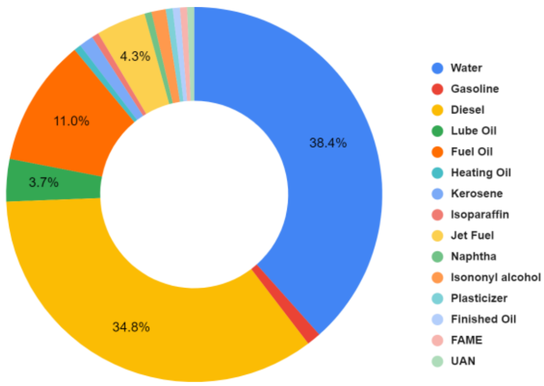
*Square Robot SR-1 Robot*

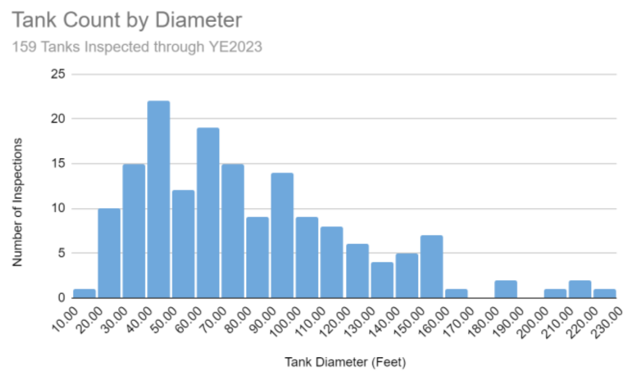
## Background

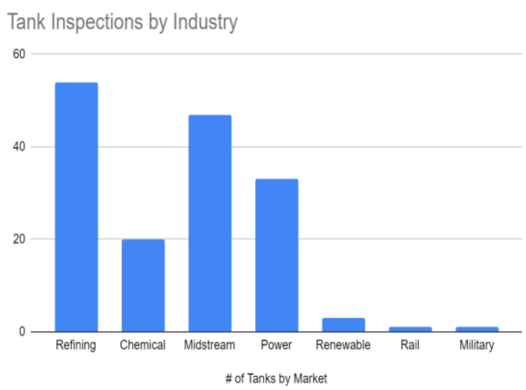
Square Robot was founded in 2016 to develop and offer submersible, autonomous robotic navigation and inspection capability to support API 653 Aboveground Storage Tank inspection requirements.  Since then, Square Robot has experience developing revolutionary products for the AST inspection industry to make tank inspections safer, more informed, and financially and operationally more efficient. Square Robot started commercial tank inspections fielding the SR-1 Inspection system in 2019 and has successfully inspected approximately 195 above ground storage tanks through May 2024, providing customers with critical data and information supporting decision and risk analysis for their tank bottom floor thickness, tank shell thickness and condition, coating condition, tank bottom settlement, and structural elements of their internal tank.

The Square Robot team includes engineering and manufacturing capabilities based out of Marlborough, Massachusetts and experienced in-house API 653 inspectors, NDT analysts, project managers, robotic field engineers, and field crews located in Houston, Texas.  We work directly with tank asset owners and through industry partners to provide the required local knowledge, safety, and expertise to deliver robotic inspection services and API 653 or risk based inspection reports with their customers .

# Square Robot Tank Inspection Profile - 200 tanks inspected




| KPI | Count |
|---|---|
| **API 653 Tanks Inspected** | **>195** |
| **PAUT Bottom Coverage (includes obstacles)** | **60% average (95% max)** |
| **Confined Space Labor Hours Saved** | **100,110 hours (630/tank avg)** |
| **CO2 Emissions Equivalent Contained** | **825,600 lbs(7,800/tank avg)** |
| **Tank Utilization** | **95% - 99%** |

| | |
|---|---|
| **Cost Savings (assume $300k x 195 tanks)** | **$58.5 million** |

# SR-1 PAUT Compliance with API 653 Annex G requirements

Square Robot's SR-1 robot is engineered and designed to support maximum tank bottom coverage and locate the Phased Array Ultrasonic Transducer (PAUT) payload as close to the tank shell in the critical zone and appurtenances to support high density UT inspection. The 256-Element PAUT is capable of corrosion and plate thickness mapping with over 18,000 overlapping UT data points per square foot.

- Quantify tank bottom plate thickness
- Differentiate between product and soil side plate corrosion and defects
- Validate coating thickness
- PAUT can be reoriented outward to support internal shell inspections for insulated tanks or if PAUT shell coverage requires scaffolding

The PAUT hardware and software support high density data delivery through the following:

- 8 x 32 element staggered probes @10 MHz
- 6 element overlap between adjacent probes
- 1.5 mm pitch
- 7 element aperture
- 208 measurements/ sequence over 312 mm length
- 44 sequences per second

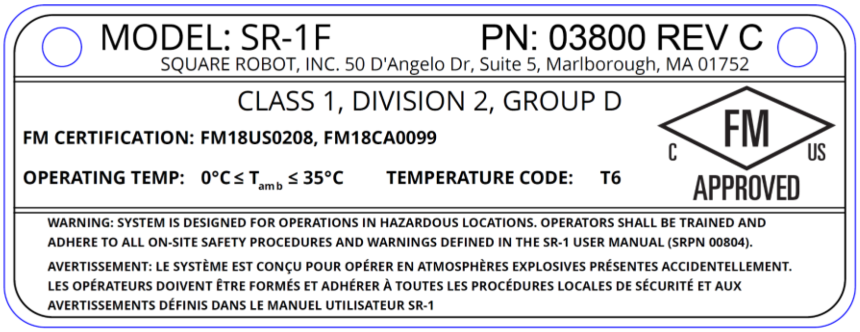
Square Robot worked with industry and customers to validate the PAUT NDT as required by API 653 Annex G and a copy of whitepaper "**Square Robot NDT Payload Validation - API 653 Plate (SRPN 02926) Test Plan and Report"** has been provided.

Testing concludes that the PAUT payload meets API-653 Annex G Qualification Test Acceptance Standards for defect sizing/prove-up. The system detected and sized more than the minimum API-653 defects. All defect sizing results were within the allowable ±0.020 inches. The PAUT system can be used to measure and characterize the remaining thickness of a low-carbon steel tank floor and can be expected to meet API-653 standards using the robot's standard procedure for surveying. PAUT results are expected to agree with those of an out-of-service MFL inspection. Please note that Square Robot also tested a Pulsed Eddy Current (PEC) payload in that study but does not use that NDT payload on our SR-1 robots.

# Robot Specifications

## Certifications

SR-1 is currently certified for use in Class I, Division 2, Group D, T6, or unclassified locations by FM Approvals. Square Robot is currently working toward Atex certification but has already successfully conducted inspection services outside of the US and Canada without that certification. The countries outside of North America where we have conducted inspections include KSA, United Kingdom, The Netherlands, and Malaysia.




*FM Approvals C1D2 Certification Label for SR-1*

## Environmental and Physical Specifications

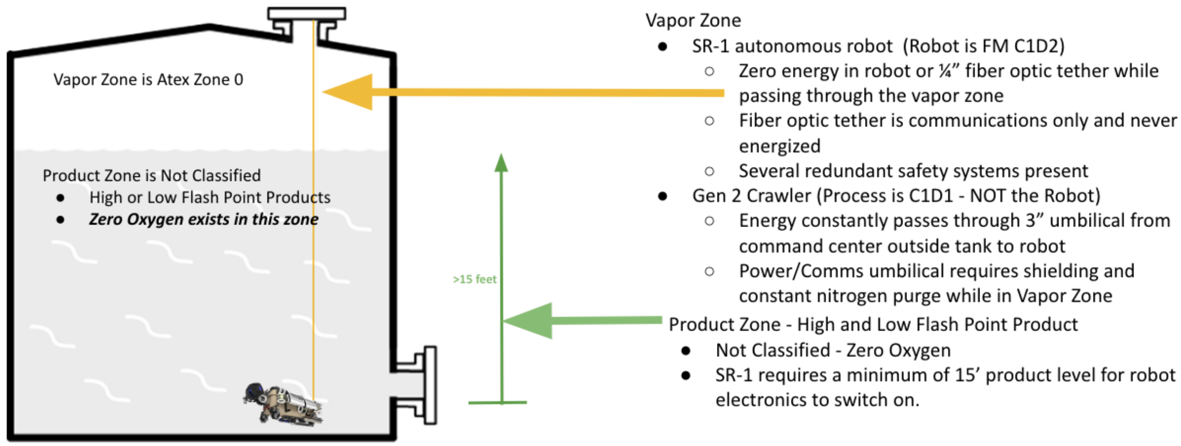
Table 1: Environmental Specifications

| | |
|---|---|
| Operating Temperature Range | 0°C to 35°C<br>*(32 °F to 95 °F)* |
| Storage Temperature Range | -10°C to 60°C<br>*(14 °F to 140 °F)* |
| Vehicle Operating Depth | 27.4 meters *(90 ft)* in freshwater<br>($P_{abs}$ = 370 kPa, $P_{gauge}$ = 269 kPa) |
| Fluid Density | 810 kg/$m^3$ to 1000 kg/$m^3$<br>*(6.8 lbs/gal to 8.3 lbs/gal)* |

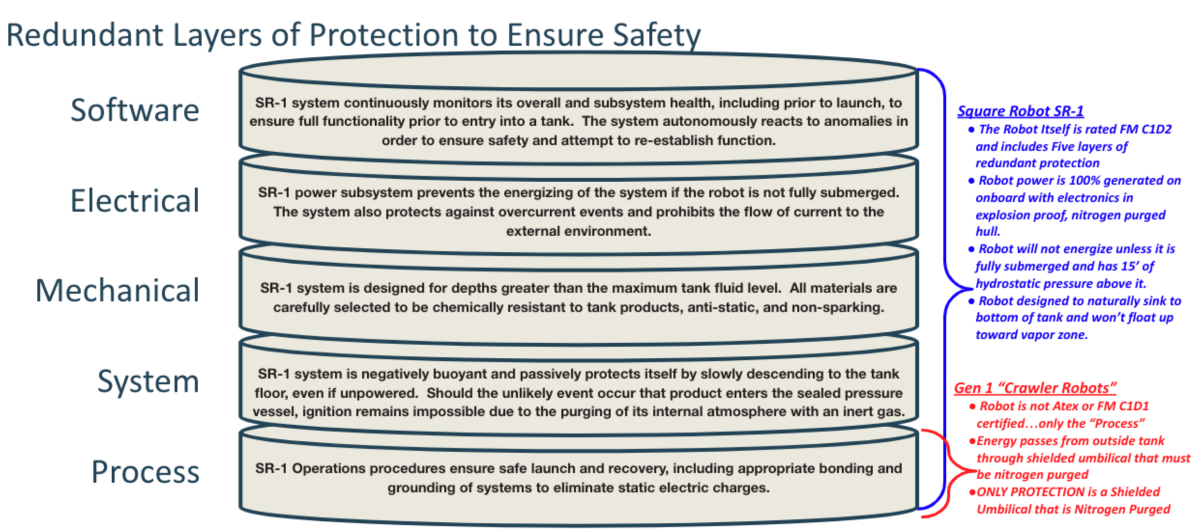
Table 2: Physical Specifications

| | |
|---|---|
| Dry Weight | W ≤ 120 kg *(265 lbs)* |
| Wet Weight | -10 kg ≤ B ≤ -4 kg<br>*(-22 lbs ≤ B ≤ -9 lbs)* |
| Major Dimensions (L x W x H) | 1.277m x 0.543m x 0.500m<br>*(4.19 ft x 1.78 ft x 1.64 ft)* |

The SR-1 robot's C1D2 certification makes it safe to operate in water and high flash point product tanks. All SR-1 batteries and electronic power are located onboard in an explosion proof, nitrogen purged hull and zero energy passes through the ¼" fiber optic tether as it is only for communications. The SR-1 is negatively buoyant so it naturally sinks to the bottom of the tank and will only power on when it is submerged below 4.6 meters (15 feet) of product.




*SR-1 Zero Energy on Roof or in Vapor Zone*




*SR-1 Redundant Layers of Safety Protection*

square ROBOT

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# Software

## Robot

Square Robot operates the vehicle via a custom-designed web user interface. Onboard software and firmware is proprietary to Square Robot, and based off of the Robot Operating System (ROS) architecture.

## Topside

Square Robot has developed several topside software tools which enable an operator to plan and successfully execute an operation. Prior to an operation, the operator plans SR-1's path inside a tank via Square Robot's PathPlanner tool. Once paths have been created, they are pushed to the robot to run. PathPlanner requires Matlab Runtime. While the vehicle is operating, Square Robot uses a web-based GUI to monitor the status of the vehicle. For data collection, a payload driver is run from an external computer. This driver collects the RAW NDT data, and stores it for later analysis.

In addition to the software described above, Square Robot has several other software tools which it has developed to help successfully plan and execute an in-service tank inspection.

Additionally, the vehicle collects and provides the operator with real time data using onboard sensors including fluid pressure, temperature, vehicle altitude off the floor. These sensor packages also provide valuable quality data information and also support data results for our tank bottom settlement report. The vehicle also collects data on internal housing pressure, internal electronics temperatures, and battery state of charge levels to ensure the vehicle is operating within acceptable parameters.

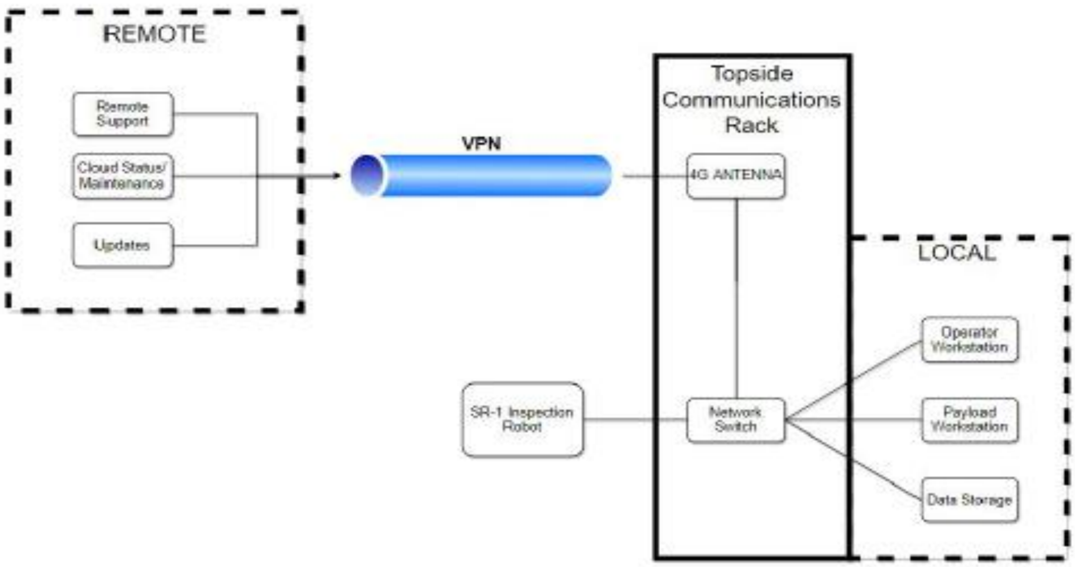
Vehicle sr1b-105 Status:
MEH Pressure: 80960 Pa
PTH Temperature: 29.0 C
Avg Battery Temp: 28.2 C
Avg Battery SOC: 82 %
Battery System Voltage: 26.66 V
Battery Total Current: 0.28 A
Current Vehicle Time: 2021-09-27 13:26:46.146934
Current Fluid: air

*SR-1 Status Message*

To navigate, SR-1 uses a combination of different sonar sensors which ensonify various parts of the tank. The inputs from these sensors are put into a proprietary algorithm to navigate through the tank, as well as to identify key obstacles such as columns, drain pipes, and sumps.

To ensure the inspection robot has collected quality data, at the end of each day Square Robot runs through a representative sample of the data collected to ensure that the ultrasonic data is of sufficient quality for analysis. That is, that the required echos are clearly visible, and external noise is sufficiently low.

## Infrastructure and communications




*Square Robot Operations Network*

Square Robot's high level communication architecture is diagrammed above. The SR-1 Inspection Robot is connected to a network switch via a 0.25 inch diameter fiber-optic tether, shown below. An operator workstation, payload workstation, and data storage module, are connected to the same network switch to form a local area network (LAN). A 4G antenna or Starlink enables Square Robot to provide remote support and updates through a VPN connection.

*Rooftop Equipment, the tether can be seen in yellow*

# SR-1 Operations and Data Processing

## Pre-Job START Service “Site Tank Assessment for Robotics ”

Robot inspections are scheduled between Square Robot, our industry partners, and end customers while in full collaboration with Square Robot operations and service leads. Square Robot heavily encourages customers to work with us to pre-screen tanks using our Site Tank Assessment for Robotics (STAR) Service to fully assess that the site and tanks are good candidates for robotic inspection, to assess and mitigate any potential risks, to ensure all health, safety, and background checks and permits are completed ahead of mobilization. Once STAR is complete then we work with the asset owner to, ideally, schedule a campaign of sequential tank inspections at a single facility, enabling all parties to deliver with the most value possible in the safest and shortest amount of time.

Before a prospective tank is scheduled, ADVCCO will request the following from its customer as part of our Site-Tank-Assessment for Robotics (STAR) program:

- Complete the Square Robot Tank Questionnaire form (Note: A sample Tank Questionnaire is provided separately for your review.)

square ROBOT

**Robotic In-Service Tank Inspection Questionnaire**

**(Key: Black Text = All Applications, Orange = Side Launch, Blue = Top Launch)**

**SECTION 1 - Required information**

| **Facility** | |
|---|---|
| **Facility Name:** | **Customer Contact Name:** |
| **Facility Contact Name & Number:** | **Tentative Inspection Start Date:** |
| **Facility Address:** | **Shipping Address** : *(If different from site address)* |
| **Crane Provided By:** ■ Client ☐ Square Robot *(cost +10%)* | **Facility Type:** ■Manned ☐Unmanned<br>**Available Work Days & Hours:** |
| **Tank** | |
| **Tank #:** 7 | **GPS Coordinates of Center of Tank:** |
| **Tank Height (ft):** | **24 Inch or Larger Roof Manway?** ■ Yes ☐ No *If Yes, # of Manways?* |
| **Tank Diameter (ft):** | **24 Inch or Larger Shell Manway?** ☐ Yes ☐ No *If Yes, # of Manways?* |
| **Roof Type:** ☐ Fixed Cone Roof ☐ Internal Floating Roof ☐ External Floating Roof ☐ Other: | **Manway or Hatch Shape:** ☐ Circle ☐ Square ☐ Rectangle |
| **# of Roof Columns:** | **Shell Manway Inner Diameter (22.75" Min):** |
| **Any Known Internal Obstructions Below or Above Roof Manway (Steam Coils, Varecs, Anodes, Floating Suction, Piping, etc.):** | **Shell Manway Ground Clearance to Center:** |
| **Date of last tank cleanout:** | **Shell Manway Internal Obstructions (ladder, gauge, etc.)?:** ☐ Yes ☐ No<br>**Shell Manway External Obstructions within 20 ft (berm, piping, etc.?):** ☐ Yes ☐ No<br>*If Yes, what is the distance to manway?* |
| **Product** | |
| **Product Name:** | **Product Density (kg/m³) or Specific Gravity:** |
| **CAS Number:** | **Product Viscosity (centistokes, cS):** |

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- If applicable, request a SDS sheet for the stored product. For chemical and petroleum products we must verify the flash point, material compatibility with critical parts of the robot, density, viscosity, and product temperature during inspection.
- Provide available tank drawings and past tank inspection reports.
- Consider conducting API 653 external tank inspection requirements on the tank ahead of robotic inspection. Specifically at that time we will assess manway size/access, tank roof safety and loading, and address other matters that may impact internal inspection.
    - Verify a minimum 610mm (24") roof manway is available or could be established with access and no internal appurtenances blocking robot entry
- Conduct sludge and sediment review for each tank using Square Robot Feasibility Assessment Tool (FAT) or some other pertinent reconnaissance method. Consider product quality, source, and the process ahead of the prospective tank.
    - Verify a minimum of 4.5 meters (15 feet) of product level will be in the tank during inspection. Our FM certified C1D2 robot requires hydrostatic pressure to switch on and navigate.
    - Verify that the sludge level and type will provide PAUT access to inspect the tank bottom. If sludge levels are greater than 1" to 2" then consider sludge cleaning before SR-1 inspection.
- Consider tank Lock Out Tag Out during inspection. If the tank is critical and requires flow during inspection then Square Robot can conduct a Flow Simulation to determine maximum safe flow conditions into/ out of the tank during inspection.

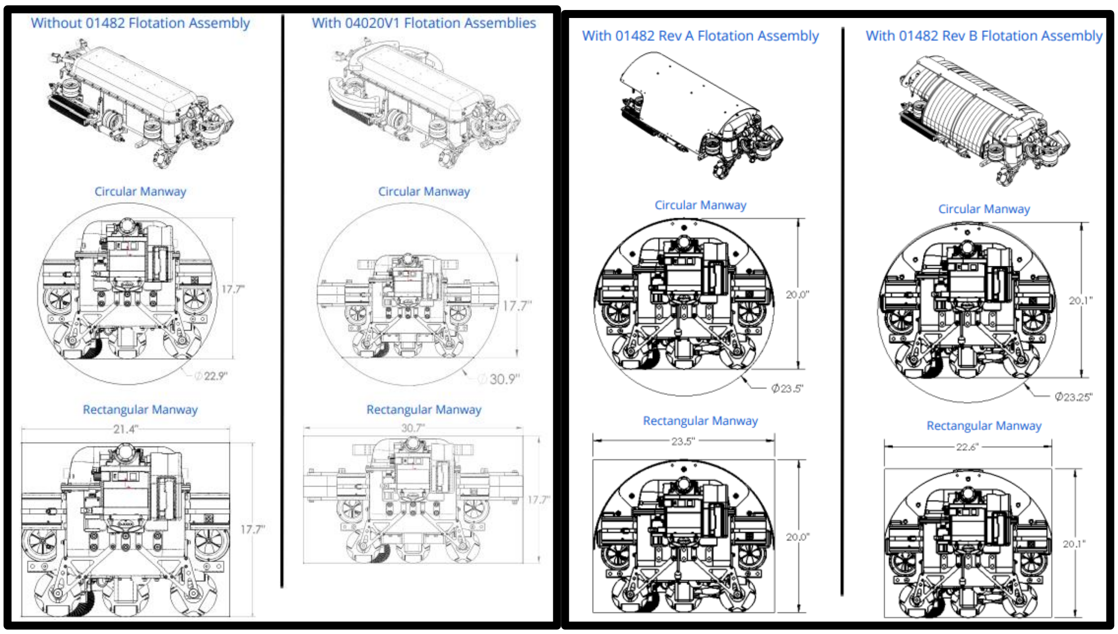
  - Assess ability to monitor product level during inspection using real time electronic gauging or static level during LOTO. This enables the SR-1 to operate in the safest possible manner and also supports the Tank Bottom Elevation service to be highly accurate.
- Conduct JSA with consideration for ADVCCO equipment and crane locations and develop initial Safe Work Execution Plan (SWEP) to support the future operation.
- Consider all HSSE and other permits and approvals that may be required for the planned job. Some HSSE considerations are illustrated in the following Table and associated documents and procedures can be provided and reviewed to ensure all requirements and concerns are met well ahead of the mobilization date. Those same approved checklists will then be reviewed onsite once the crew arrives on location for the inspection work.

Table 3: Select list of Major Pre-Launch Checklists

| # | Checklist Name | Purpose |
|---|---|---|
| 1 | Van -Prejob Checklist | To ensure equipment and inspection vehicles are properly prepared for a job. |
| 2 | Daily Pre-Ops Checklist | To ensure personnel, inspection vehicles, and equipment are prepared for the day’s operations. |
| 3 | Pre-Dive Checklist | To Ensure the SR-1 Vehicle is prepared to dive into fluid and perform that day's operations. |
| 4 | Roof Equipment (may vary by roof) checklist | To ensure all equipment is brought to roof in minimal trips |
| 5 | Launch & Recovery (may vary by roof) checklist | To ensure proper launch and recovery procedures are followed |
| 6 | Post-Dive Checklist | To clean the vehicle and ensure it will be in good working order prior to next day’s operations. |

Once checklists 1-4 in the table above and a pre-job PAUT calibration (see Square Robot 04176RD - DOC, PROCESS INSTRUCTIONS, PAUT PAYLOAD STANDARDIZATION) is completed, the operations team will use a third party crane to hoist the robot, and any auxiliary gear, to the roof. Once on the roof, the team will launch SR-1 into the tank by completing checklist 5.

Square Robot currently deploys its SR-1 inspection vehicle through the roof manway on an aboveground storage tank. Square Robot designed SR-1 to fit inside a 24 inch diameter roof manway, but has also worked with customers to fit through manways of many different sizes and shapes. The below figures give an overview of the minimum manway profile required in order to deploy SR-1 in an aboveground storage tank.




*SR-1 Manway Minimum Specifications*

Once the robot  has been launched through the vapor zone or air gap using the mechanical davit or crane, it will sink naturally toward the bottom of the tank and power on at a predetermined depth below the product surface to conduct the inspection. The robot operator will use the Square Robot web-based GUI to control and monitor the robot throughout an inspection. Once all inspection missions for an agreed upon day have been completed, the robot will be pulled back underneath the manway. The field team will then complete the recovery checklist to recover the vehicle, and the post-dive checklist to inspect the vehicle, download the data, and charge. The operations procedure will repeat for each day of operations. At the end of each day, the data collected is uploaded and a representative sample of the PAUT is analyzed to ensure the dataset can be processed.

Once the entire job is completed, the Square Robot team of NDT Analysts, working from a central cloud based secure server, will process the acquired data through a cloud based server where they can work in parallel and conduct peer reviews. The PAUT data analysis is combined with the acquired visual data, and an internal API 653 Inspection Report is created. Additionally, Square Robot processes the navigational data collected to create a map of tank bottom elevation per API 653.  Square Robot's API 653 reports include: Tank Bottom thicknesses and corrosion rates, any major defects found, a map of Tank Bottom Settlement, visual data acquired in the tank, and, if desired or warranted to improve confidence levels where PAUT coverage is more limited, an Extreme Value statistical Analysis (EVA).

## Equipment and Crew Mobilization and Demobilization

ADVCCO will mobilize crew and equipment from its nearest field service location or directly from another customer location in KSA. All required equipment, replacement parts, and personnel will be located in KSA during times when WTTCO plans to inspect tanks.

The customer's responses and available information provided during a pre-job onsite STAR service will allow Square Robot to determine whether the desired tank is a good candidate for in-service robotic inspection. The drawings are important so Square Robot can assess internal hazards inside the tank, prepare keep-out areas, and recreate the tank floor geometry inside its data analysis software. Finally, ADVCCO will conduct any pre-site training, fulfill customer/local HSE and security requirements, and conduct final project reviews before its field crew mobilizes and accesses the site. Please find the tank questionnaire attached to this report as Appendix VI.

On the days of the inspection, the ADVCCO and Square Robot operations team will arrive onsite using its self contained equipment and control center van. The van supports transport and storage of all required equipment, including the SR-1 Inspection Robot.

Roof lifts can be conducted by a third party crane or, as available and if requested, a Bocker equipment lift system that can be pulled by trailer to location and operated by the onsite crew.

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*Logistics and Control Center with Bocker Lift System*

**Project Personnel**

Project personnel include the following and may be employed by either ADVCCO or Square Robot. Regardless, key personnel managing operations onsite will be fully certified and trained to provide required services.

- SR-1 Robot Engineer - Onsite
- API 653/NDT Certified Technician - Onsite crew and authorized signature
- Technician / Rigger - Onsite crew
- NDT Analyst - Square Robot personnel located in central location to process, analyze and report PAUT and other NDT data

**Project Equipment**

- ADVCCO Mobile Van - Provides equipment storage and acts as a command center for the operations crew to monitor the SR-1 robot from outside of the tank
- Square Robot C1D2 certified SR-1 inspection robot - Equipped with 12” PAUT payload, sensor facing and outward facing camera.
- Launch and recovery equipment
  - Bocker Lift System or Third Party Crane
  - Davit crane
  - Bonding/grounding cable and lugs
  - Fall protection barricade
  - Temporary manway cover
  - Spill containment and absorbent pads
- Mobile Operations Van to be located near tank
  - A climate controlled work space suitable for up to 3 people

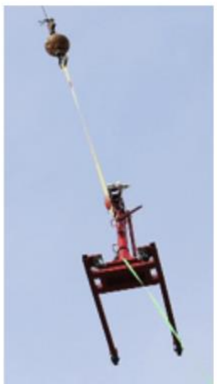
- A table or desk that can fit at least 1 person, 2 computer monitors (24”) and 1 laptop
- An electrical panel that allows for a portable generator to be setup outside the trailer to provide the unit with power
- 110VAC or equivalent outlets with adaptors (min QTY 4 needed, w/15A equivalent breaker) on interior to power our computers and monitors
- Ability to lock the unit up at night

## Safe and Environmentally Sustainable Operations

**Scope of Work – Launch and Recovery**

- Use Bocker Lift System or Crane to lift the SR-1 inspection robot/cradle, tool box, temporary barricade and manway cover, and davit to the top of the tank in 3 to 4 separate lifts. The davit is the heaviest and tallest lift weighing approximately 295kg (550 pounds) and requires roughly 3 meters (9 feet) clearance above rails and roof top.
- Prior to launch, the manway is removed, and our temporary fall protection barricade is installed around the manway for the duration of the inspection.
- The robot is then lifted with the davit mechanical winch or directly from the crane using the Square Robot provided latch block system and positioned over the manway to launch into the tank.
- After launch, and during operations, a temporary manway cover is installed to minimize emissions and provide fall protection.
- Onboard battery life generally supports six to eight hours of navigation and inspection survey time before recharging the batteries. Battery life may be reduced to support navigation in highly viscous products such as lube oil. Once the inspection is complete for the day, the robot is recovered through the roof manway, with careful consideration taken to clean the robot and contain any product drips.
- The manway is reinstalled, and the robot is lowered down to be charged overnight.

**Lift 1: Davit**
**Weight: 650 lbs; Height 6 feet**



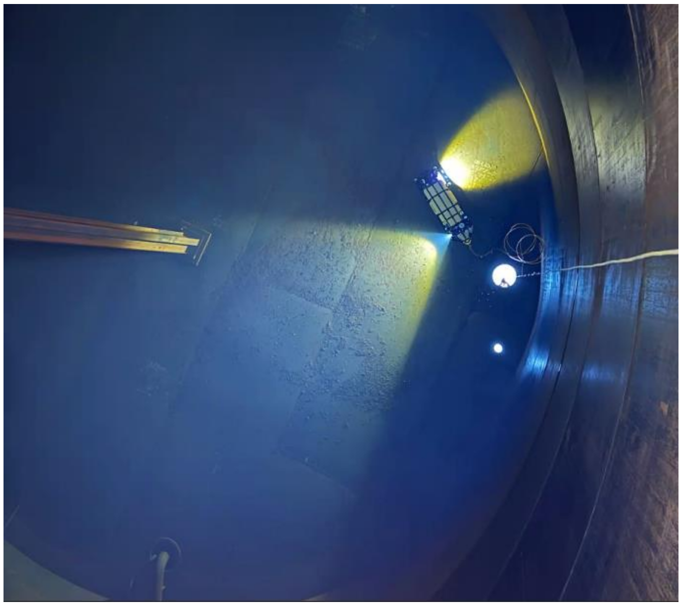
**Lift 2: Tool Box**
**Weight: 200 lbs; Height 2 feet**


**Lift 3: Robot and Cradle**
**Weight: 365 lbs; Height 4 feet**


*Crane Lifts to Tank Roof*

*Davit, Comms Tether, Barricade and Robot Over Manway*


*Robot Recovery through Manway; Decontamination Process*




*Robot Recovery through Manway; Decontamination Process*

## Charging Scenarios:

**Option 1**
- Primary charging system is battery-backed and robot is charged inside our trailer

**Option 2**
- Protected and secure building/location
- 110VAC, 15 Amp

*Robot Lowered to Ground for Battery Charging Between Missions;  Data Uploaded*

# Autonomous Robot Navigation and Inspection Capability

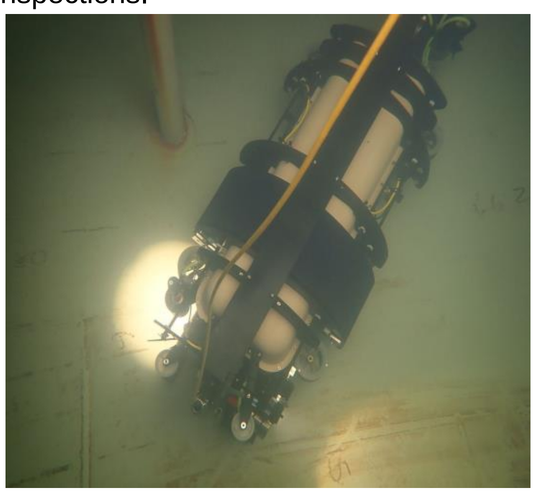
Square Robot uses the following data sensor payloads in order to perform these services:

1. SR-1 provides a 256-Element Phased Array Ultrasonic Transducer (PAUT) payload capable of corrosion and plate thickness mapping with 18,096 overlapping UT data points per square foot.
    - Quantify tank bottom plate thickness
    - Differentiate between product and soilside plate corrosion and defects

2. The PAUT hardware and software support high density data delivery through the following:
    - 8x32 element staggered probes @10 MHz
    - 6 element overlap between adjacent probes
    - 1.5 mm pitch
    - 7 element aperture
    - 208 measurements/ sequence over 312 mm length
    - 44 sequences per second

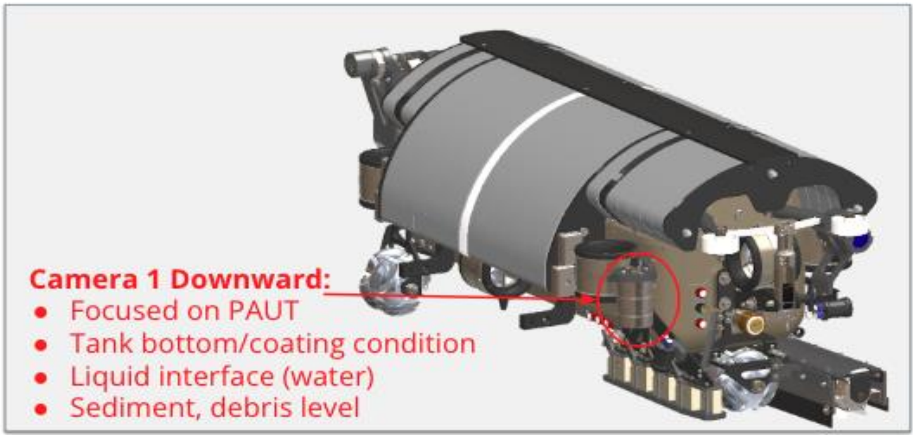
3. Square Robot worked with industry and customers to validate the PAUT NDT as required by API 653 Annex G and a copy of "**Square Robot NDT Payload Validation - API 653 Test Plan and Report"** can be provided.

4. Two high definition video camera payloads
    - SR-1 includes two visual cameras with minimum full HD resolution (720 progressive scan & LED light), providing video and still picture capturing during confined space inspections.



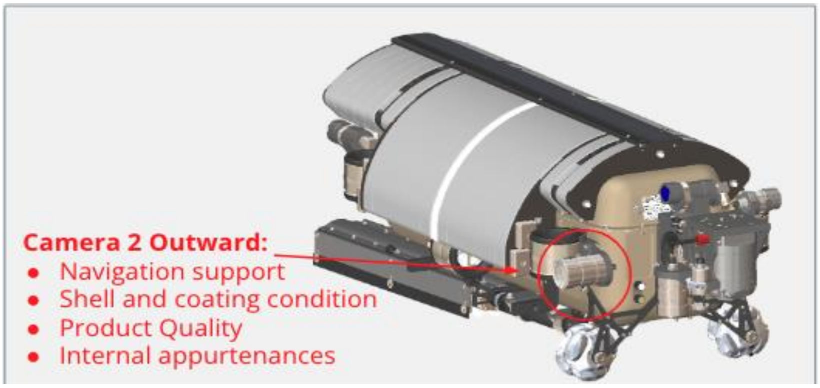
*Overview of Robot Operating in Tank; Fiber Tether and Camera Light*

    - Camera 1 - downward facing focused on PAUT payload area to provide qualitative video and still picture information of inspected area including bottom coating, corrosion, and defects



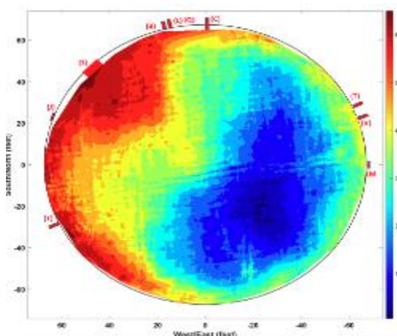

*Camera 1 Downward*

- ○ Camera 2 - outward facing to support robot navigation and provide qualitative inspection of tank internals including shell, columns, and other appurtenances.




*Camera 2 Outward/Configurable*

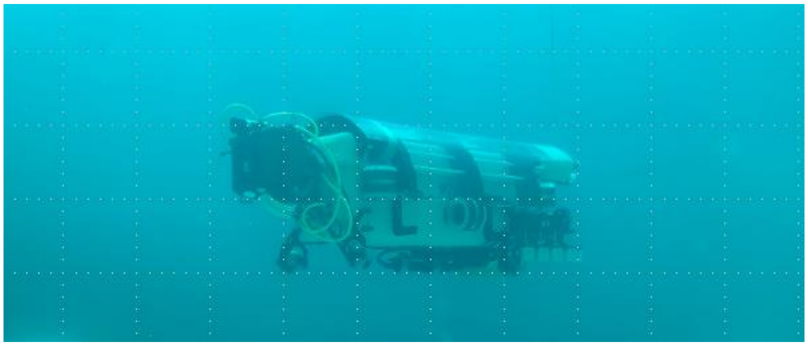
5. Tank Bottom Settlement Survey: SR-1 provides a tank bottom settlement evaluation under fully loaded tank conditions while the tank remains on-line. Details behind the engineering and development of Square Robot's in-service tank bottom settlement report can be found in Square Robot's white paper "**03845R4 - WP Robotic In-Service AST bottom differential elevation survey"** that can be provided or found on our website.



Bottom settlement map of 135' diameter tank under load

**Autonomous Navigation**

Square Robot's SR-1 robot operates autonomously inside the tank and is able to hover, swim, and roll along the tank bottom while conducting its surveys.

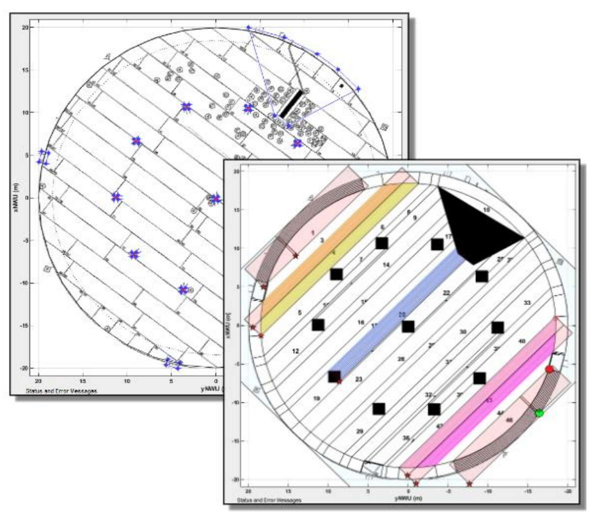


*Robot hovering*

SR-1 is equipped with a proprietary, on-board navigation system that allows the robot to navigate safely and autonomously throughout the internals of an aboveground storage tank. This sophisticated system, the robot hardware, payload configuration, and small 6mm (¼ inch) diameter, floating communications tether allow the robot payload to inspect close to known obstructions and is accurate within 150 mm (6 inches) of its location within the tank.

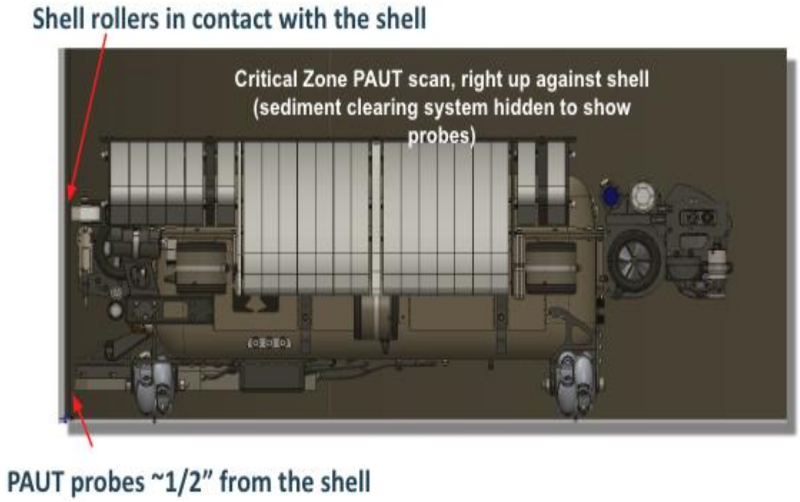
The navigation sensor suite is self-contained in the robot and includes:

- Inertial navigation system
- Doppler Velocity Log with pressure sensor
- Acoustic echo-sounders
- Sound velocity sensor



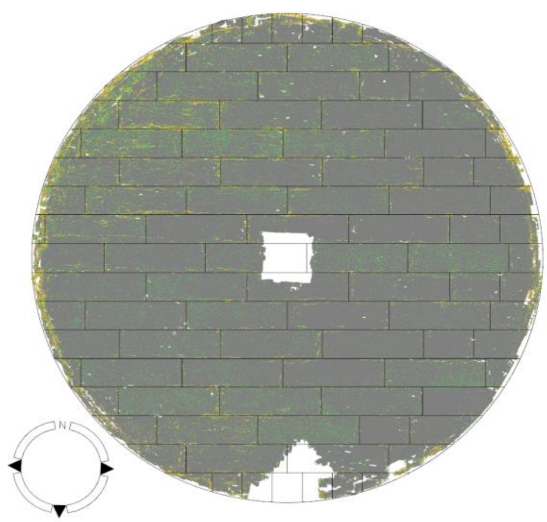
An important aspect of autonomous navigation is to operate safely and avoid areas of potential trouble. Exclusion zones are created to keep the robot a safe distance away from potential problem areas such as sumps, mixers, columns, and other types of known internal appurtenances. Unknown internal appurtenances are identified by the robot during its initial navigation setup of the inspection mission and a revised navigation plan may then be created from its learnings to also exclude newly identified areas while maximizing inspection coverage areas.

SR-1 is designed and able to cover the tank bottom critical zone scanning within 12 mm (0.5") from the shell. We accomplish this through the robot hardware design and configuration, its highly accurate autonomous navigation system and software, and the light and nimble communications tether.




**<u>Scope of Work – In-Service PAUT Inspection</u>**

- The SR-1 robot will scan the tank bottom utilizing a 12" PAUT payload and high definition video to provide supporting data when/if visibility permits
- Provide maximum floor coverage with high density 256 element PAUT given customer requirements and priorities.
  - Exclusion Zones: Exclude zones around tank bottom obstructions including sumps, columns, piping, mixers and other appurtenances that must be avoided.
  - Sediment: Our sediment removal system is highly effective at eliminating typical sediment in clean products tanks. However, some tanks may contain areas with sediment buildup greater than 50mm-75mm (2" to 3") that impacts inspection coverage.
  - Critical Zone: Initial focus to provide maximum coverage within 0.5 inches (13mm) from tank shell
  - Tank Bottom: Maximum plate coverage over proposed time period



SR-1 has demonstrated and proven a consistent capability to deliver tank bottom inspection coverage area greater than 95% as illustrated in the following example of a 100’ diameter tank with one center column and a sump area with nozzle in the lower south portion.

However, tank bottom coverage may be more limited with resulting coverage below 90% by any or all of the following conditions

- ***Asset owner inspection goals for a different coverage level. For example the asset owner may only pursue 10% tank bottom PAUT coverage for an API 575, risk based inspection***.
- The volume and consistency of sediment and sludge on the tank’s bottom is greater than the capacity for SR-1 sediment removal system to manage
- The type, location, and orientation of internal appurtenances, columns, sumps may prevent access to certain locations on the tank bottom
- The tank bottom condition
- The time available to Square Robot by the customer to obtain maximum tank bottom coverage
- Non-homogenous product mixing near the tank bottom floor
- Coating type and thickness that prevents acquiring high quality PAUT data quality
- Tank bottom condition that prevents acquiring high quality PAUT data

## Data Processing and Analysis

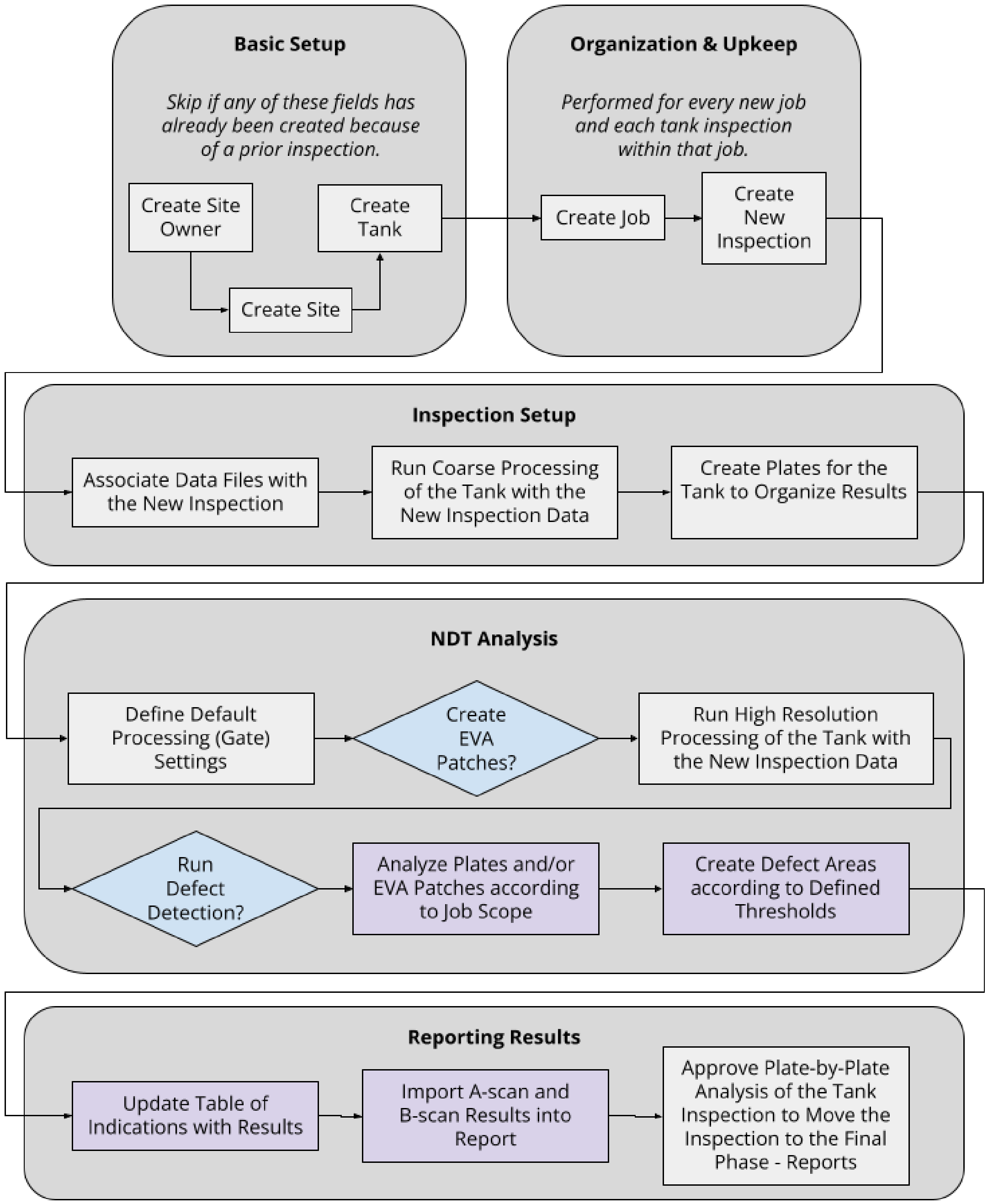
At Square Robot we understand and respect each customer’s concern for data security, quality, and integrity as part of its due diligence and relationship with its suppliers. The data we collect on each tank inspection job includes very large 0.500 - 1 Terabyte data sets from multiple sensors that can independently, or together, create great value for our customers.

Square Robot provides an API 653 PDF report and visual files from our inspections but recognize that more value can be created by evolving access, visualization, and management across entire tank fleets to more efficiently, effectively manage risk.  Therefore, Square Robot can also upload PDF and Video data files to a third party or internal data management systems to support your specific requirements.

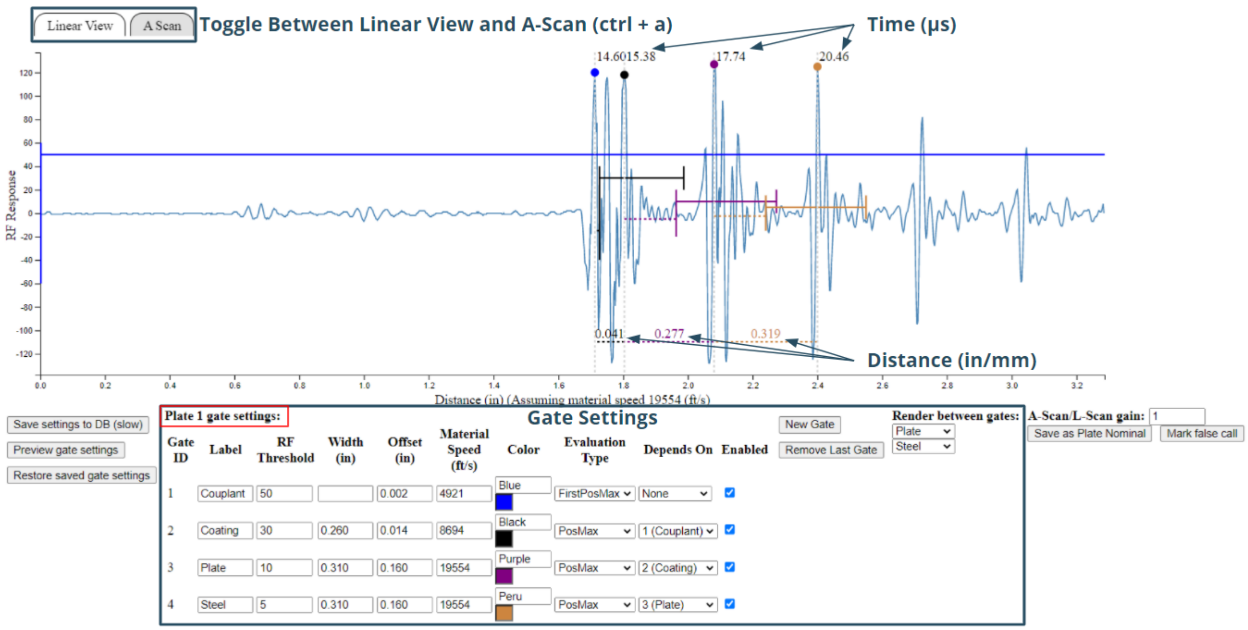
The following slides are illustrative of Square Robot’s data processing and reporting process.  At the end of each inspection day all inspection and navigation data is uploaded to Square Robot’s secure network for data processing by our team of analysts and API 653 inspectors.  While all data is processed by our team the results can be shared with local API 653 or EEMUA 159 inspectors as agreed upon by customer and local inspection partners to be incorporated with other inspection data and for their recommendations and comments.

Vat is Square Robots cloud-based analyst tool and can be accessed from any browser. Vat performs multiple functions including data storage, organization, analysis, and report generation.

The following workflow shall be followed by the assigned reporting leads and NDT analysts. The scope of this document is highlighted in purple within this workflow.




The A-Scan shows the receive signal from the selected element, also referred to as a cycle. A-Scans are used to measure the thickness of the steel and coating. NDT analysts are assumed to have an understanding of the physical properties of an A-Scan. The gate settings used to determine the thickness measurements of the selected area are shown in this view. The default gate settings are defined in a previous phase in the Vat workflow.



Analyzing with both the A-Scan and B-Scan is necessary to verify whether an indication is a wall loss finding or a false call. The image below shows how to correlate the points in time (µs) on the A-Scan selected for sizing by the gate settings with the y-axis (time, µs) of the B-Scan.

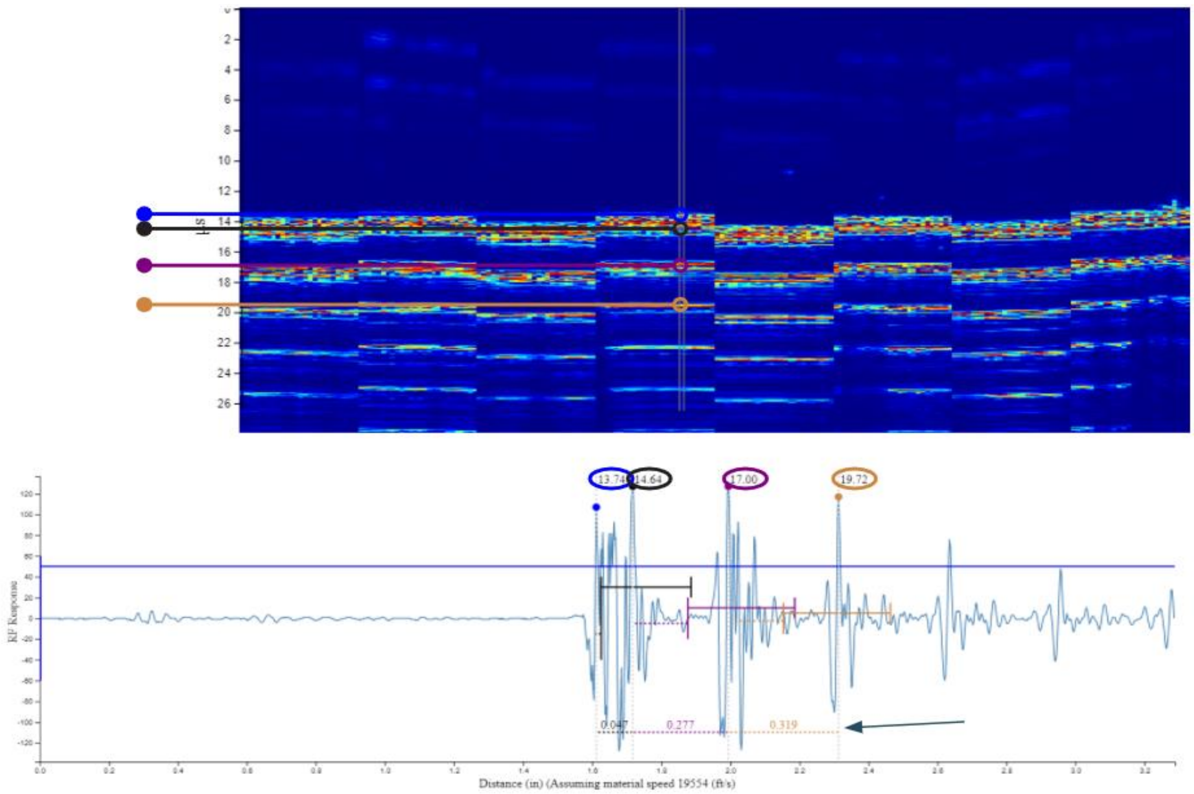



**Plate 1 gate settings:**

| Gate ID | Label | RF Threshold | Width (in) | Offset (in) | Material Speed (ft/s) | Color | Evaluation Type | Depends On | Enabled |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Couplant | 50 | | 0.002 | 4921 | Blue | FirstPosMax | None | ☑ |
| 2 | Coating | 30 | 0.260 | 0.014 | 8694 | Black | PosMax | 1 (Couplant) | ☑ |
| 3 | Plate | 10 | 0.310 | 0.160 | 19554 | Purple | PosMax | 2 (Coating) | ☑ |
| 4 | Steel | 5 | 0.310 | 0.160 | 19554 | Peru | PosMax | 3 (Plate) | ☑ |

New Gate
Remove Last Gate

**Render between gates:**
Plate
Steel

# API 653 Reporting

**Deliverables - Deliverables include the following items:**

1. Depending on project duration, ADVCCOshall conduct a Day 1 Debrief or exit meeting prior to demobilizing from the project site.  This meeting will be to discuss inspection findings and/or safety related items as demonstrated in the Sample Day 1 Debrief in the associated example.

# Day 1 Debrief

## PAUT Review

The data quality is acceptable with good readable echoes. Some points of interest found and to be analyzed further.

- Nominal plate thickness .250-inch
- At the end of day one the average thickness reading was 0.244-inch to 0.253-inch with a low of 0.244-inch so far.
- Some PAUT quality is not good due to the water and excess sediment in the tank
- Overall PAUT signals are of acceptable quality.

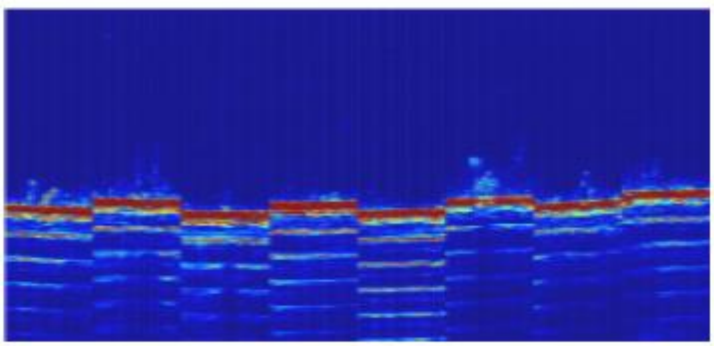


Figure 7 - B-Scan shows good coating with strong echoes

Figure 8 - A-Scan reading 0.249-inch

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## Secure Encrypted Upload

### General Data and Cyber Security

Square Robot employs a highly-regarded Managed Security Service Provider, ensuring company-wide data and cyber security best practices such as:

- Critical data redundancy and recovery planning
- Unified device and identity access management
- Enforced multi-factor authentication (MFA)
- Network and cloud service security logging and monitoring
- Security awareness training

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Business Sensitive 11 10

# Day 1 Debrief

## Images

### Internal

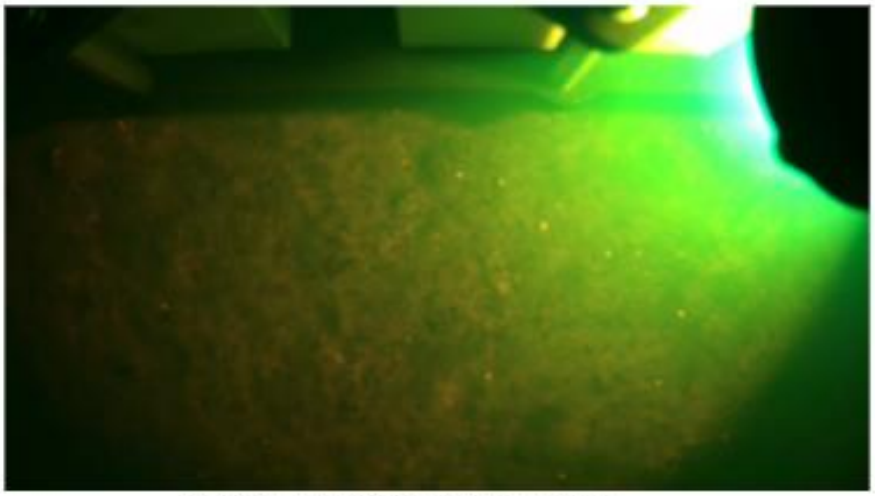

Figure 3 - Tank Y Bottom, Initial Landing

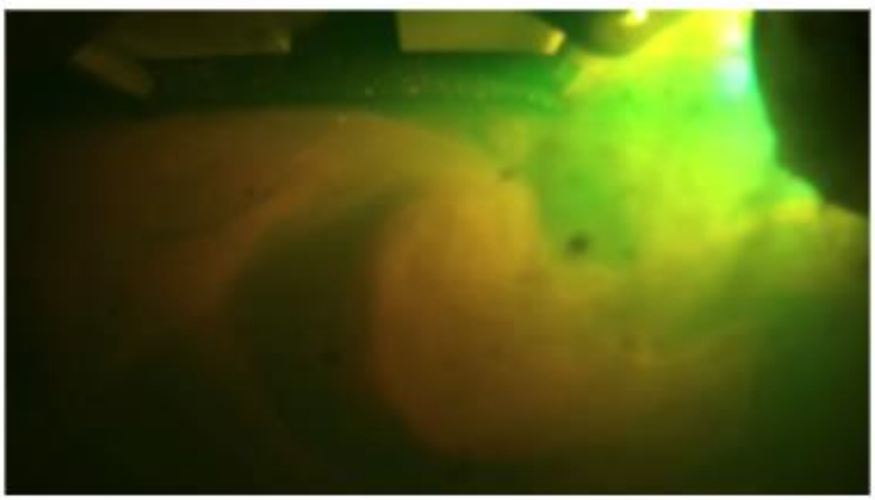

Figure 4 - Tank Y Bottom, Fine Sand

2. A preliminary report will be provided within 7 days of project execution that includes a coverage map depicting robotic scan coverage area, preliminary internal findings, and if within scope, an external tank survey.

3. A final API 653 Compliant Inspection report will be provided within 15 business days after project execution. A sample API 653 Report has been provided for review and as part of the RFQ submission and can be tailored to specific needs of the customer.
    - Internal and external inspections as required and including.
    - Drawing / map and feature list of remaining thickness and identified defects
    - Visual inspection/confirmation of problem areas when/if visibility permits will be provided in PDF form and can also be uploaded into a server area requested by the customer.
    - Tank bottom settlement (*uniquely,* under fully loaded tank conditions) - Please review our whitepaper “**03845R4 - WP Robotic In-Service AST Bottom Differential Elevation Survey”**

# Extreme Value Analysis (EVA)

Extreme Value Analysis (EVA) is a statistical tool used to model the behavior of a process at unusually larger levels than normally observed. For tank bottom inspection, the process is corrosion and the focus of EVA is on the largest bottom thickness loss within sampling areas. Since it is a statistical tool, EVA allows extrapolation of the sample inspection data into uninspected areas of the tank bottom, as long as the sample data is representative of the tank’s overall corrosion behavior. This condition can be achieved by selecting a sufficient number of evaluation areas randomly distributed over as much of the tank bottom surface as possible. EVA can be applied to partial tank bottom Phased Array Ultrasonic Testing (PAUT) scans or to maximum coverage scans in order to provide a prediction and confidence level of the maximum bottom thickness loss that would have been observed if the entire tank bottom had been scanned. It is also possible to plan the robot’s trajectory to ensure that areas of concern (based on knowledge of the tank’s corrosion history) are scanned. The benefit of this approach is a shorter inspection that provides representative sample data that can then be reliably extrapolated to the entire tank surface.

Square Robot’s EVA methodology includes 3 sequential steps:

- PAUT Data Acquisition
- Processing of the acquired PAUT data
- Extreme Value Analysis (EVA)

These 3 steps are detailed in a separate document entitled "Square Robot EVA Methodology" provided with this proposal as a separate document.

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# SR-1 Inspection Robot Comparison with Competitor Robots

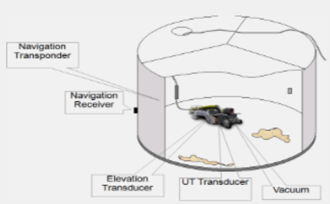
SR-1 robot was engineered and designed specifically to overcome some of the issues demonstrated by the Generation I "Crawler" robots that have been used to support in-service internal API 653 and Risk Based Tank internal tank inspections over the past years.

Generation I "Crawler" inspection robots provide limited tank bottom inspection coverage and obtaining high quality data is challenging due to a confluence of reasons that include the following:

- Energized and manually controlled from outside the tank
- Typically positioned by external acoustic transponders
- Use a large diameter umbilical used for both robot energy and communications.
- Use Magnetic Flux Leakage (MFL) and a few or an array of conventional UT probes as their NDT payloads. MFL requires clean tank bottom floors to obtain quality data which proves challenging to obtain during in-service robotic inspection.

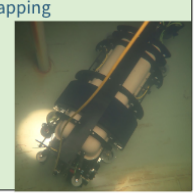
**Generation I Robot**
**Crawling**

- FM Class 1 Division 1 (C1D1) compliance through process/nitrogen blanketing ***procedures***
- 3" diameter umbilical support external power/communications
- Power/navigation from outside of tank
- Positioned using external acoustic transponders
- Payloads include Magnetic Flux Leakage (MFL), Spot Ultrasonic, Visual (outward)
- Minimal floor coverage




**Square Robot's SR1 Robot**
**Autonomous, Swimming, Hovering**

- FM Class 1 Division 2 (C1D2) certified ***robot***
- Operating procedures could be certified C1D1 similar to Gen1
- ¼" fiber optic communications cable
- Onboard power/autonomous navigation
- Onboard positioning sensor package
- Payloads include Phased Array Ultrasonic (PAUT) and two Cameras (outward/floor)
  - Plate thickness over entire coverage area
  - Product/Soil Side corrosion and defect mapping
  - Sediment/sludge mapping
  - Tank Bottom Settlement
  - Visual (Outward & Floor)

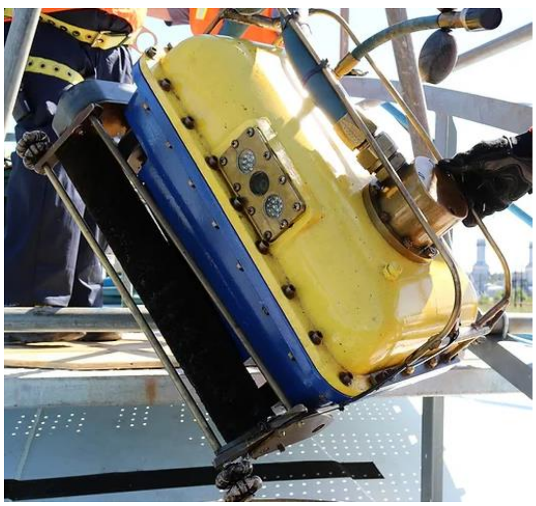


Small Swimming Robots that compete with Square Robot's SR-1 in the industry today have not proven to offer the requisite high confidence NDT data density and coverage to effectively manage API 653 compliance and risk

- Carry only small or point UT payloads so data density is limited and 10% coverage in large tanks is very difficult and time consuming to achieve (see section relative to UT coverage versus UT data density).
- Typically these are single element UT transducers and do not provide real flaw detection capabilities.
- Are not autonomous and are navigated visually by operator outside of the tank

- Navigation methods are limited and aren't able to accurately determine corrosion and defect locations.


*Single conventional UT probe swimming systems*



*8 conventional UT probes crawler system*

The SR-1 offers new technology that enables significantly more tank bottom coverage, higher density data, the closest inspection access to the tank shell, and the highest quality data and resolution possible even in relatively challenging internal tank conditions.

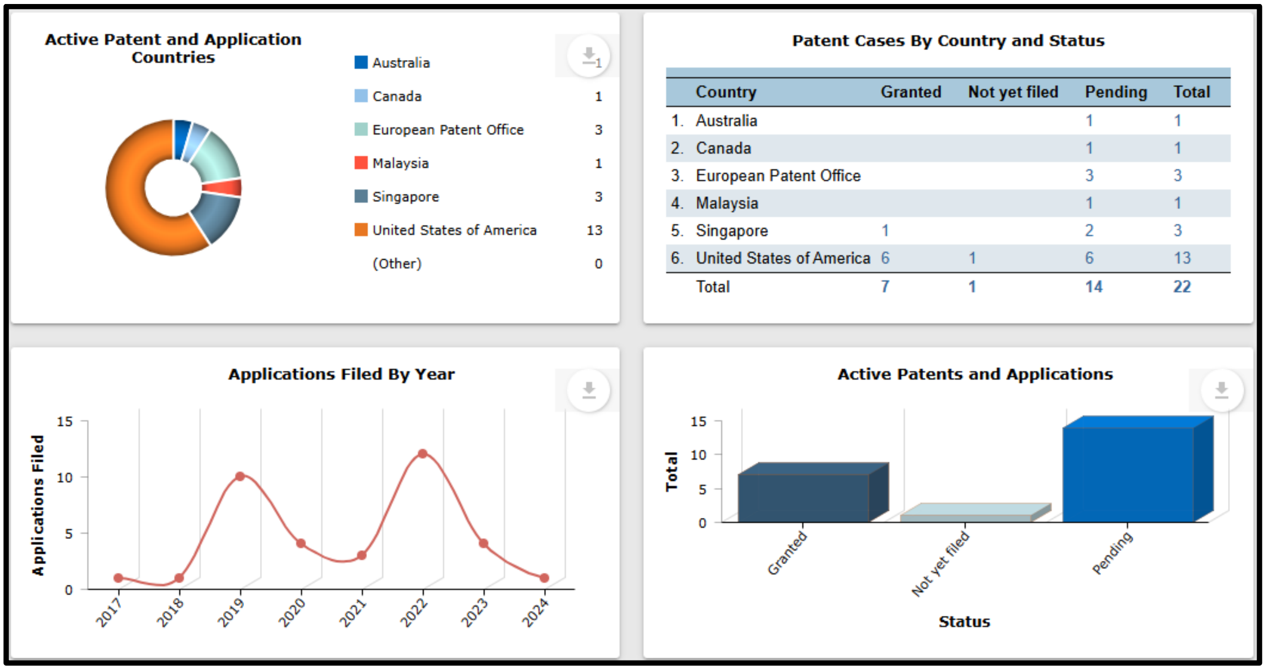
- On board batteries and electrical power in a nitrogen purged pressure vessel
- Autonomous, high precision navigation that allows the robot to control its missions locally and without visibility that is typical when inside tanks and the products they store
- Small ¼" communications tether that floats above the robot and tank floor
- 256 element PAUT is light and stands 2" above the tank bottom floor and ½" away from the tank shell can penetrate coatings, sediment, sludge.   The PAUT obtains over 18,000 UT data points per square foot.
- Two onboard cameras focus downward (at the area covered by PAUT) and outward

(supporting inspection and navigation) to reinforce other data acquired

- Additional sensors provide high resolution data to support a Tank Bottom Settlement survey, uniquely, under fully loaded tank conditions.
- Additional payloads can be added to support other types of internal tank surveys and inspections in the future.

## Patents

The following is an overview of Square Robot's patents used to perform its SERVICES / for delivery of GOODS.



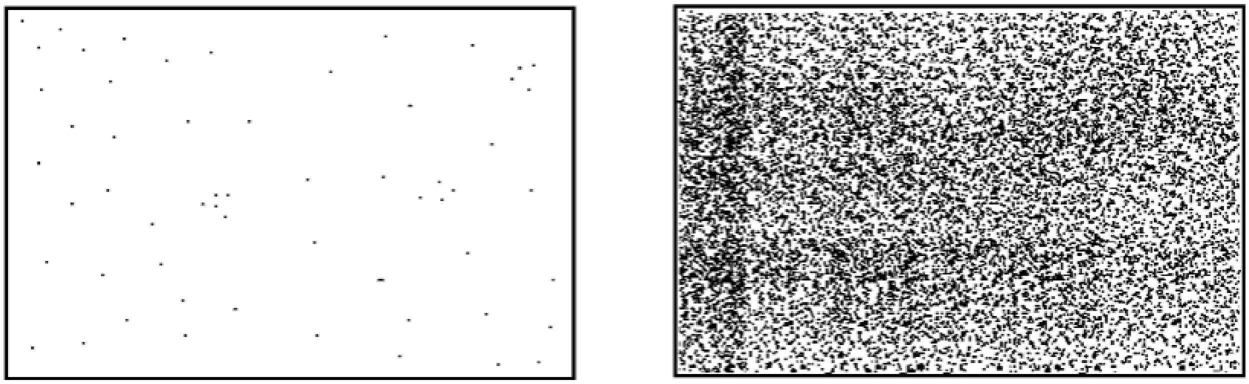

Patent Cases By Country and Status

| | Country | Granted | Not yet filed | Pending | Total |
|---|---|---|---|---|---|
| 1. | Australia | | | 1 | 1 |
| 2. | Canada | | | 1 | 1 |
| 3. | European Patent Office | | | 3 | 3 |
| 4. | Malaysia | | | 1 | 1 |
| 5. | Singapore | 1 | | 2 | 3 |
| 6. | United States of America | 6 | 1 | 6 | 13 |
| | Total | 7 | 1 | 14 | 22 |

## PAUT Data Density and Area Coverage

The figure below shows the location of thickness measurements made within 2 plates as black dots. One could argue that both plates were covered at 100% because uniform thickness sampling was achieved within them. However, the plate on the right shows a much higher density of thickness measurements than the plate on the left. Each thickness measurement is shown as a dot when it is in fact generated by a small ensonified area of the plate around the dot. So, one could consider drawing a little circle around each dot to represent the area that was actually ensonified and used to determine a thickness. When doing so in the image on the left, the surface of the plate would not be fully covered by the circles (<<100% coverage). The surface of the plate on the right would not only be fully covered, but there would be overlap between circles (100% coverage).

Therefore, claiming 100% coverage of an area with low data density is misleading. A single traditional UT probe system should add the area covered by the probe at each measurement and keep making more measurements until the sum reaches 10% of the total tank surface.



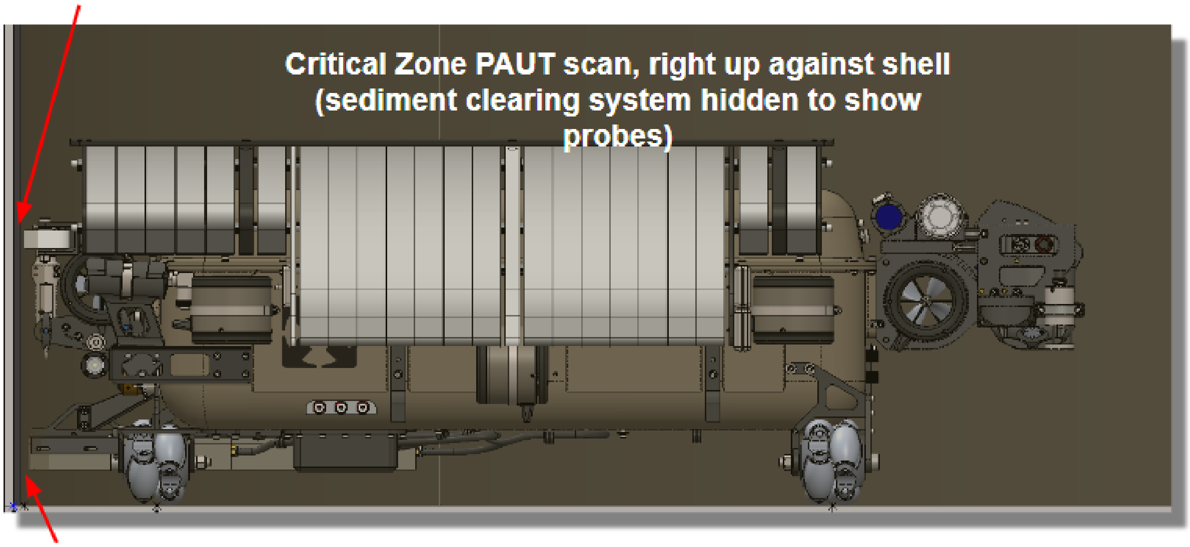
*Each dot represents the location of a thickness measurement. Both plates show 100% coverage but the data density on the left is less than 1% the data density on the right*

SR-1's PAUT system uses a 256 element array with a total active length of 0.312 m. Every time the array is fired, 208 thickness measurements, 1.5 mm apart, are made along that length. The array is fired at 44 Hz which results in 9152 thickness measurements per second. At a speed of 15 cm/s, this is equivalent to over 18,000 thickness measurements per square foot. SR-1 therefore generates PAUT data density that is similar to the plate shown on the right in the figure.

## Critical Zone PAUT Scan

The PAUT array in SR-1 is mounted towards the back of the vehicle. When scanning the Critical Zone (CZ), the robot backs up against the shell until its two shell rollers make contact with the shell. At that point, the robot is in contact with the bottom, its back is against the shell, it's pointed towards the center of the tank, the PAUT array is within ½" of the shell. The robot can then move sideways while maintaining contact with the shell. This method provides a high density, continuous scan of the accessible CZ.

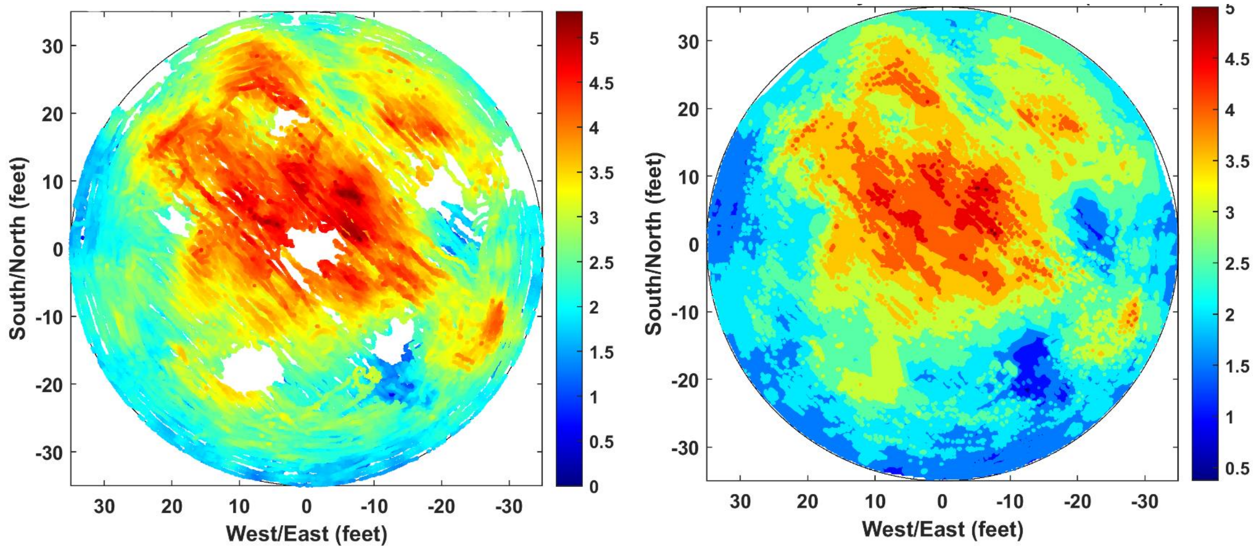
Shell rollers in contact with the shell




PAUT probes ½-in from the shell

## Tank Bottom Settlement

SR-1 provides a novel and safe approach to differential bottom elevation measurements using its onboard pressure sensor while surveying Aboveground Storage Tanks containing water or hydrocarbons. Using the acquired depth measurements, coupled with the robot's positional data, Square Robot can uniquely provide an accurate Differential Elevation Map of the entire tank bottom while in its fully loaded condition from the product head pressure. This comprehensive methodology utilizes a single dataset to more extensively evaluate tank shell, edge and localized bottom settlement providing tank owners with asset integrity information without disruption to service. The figure below shows an example of bottom settlement map




*Bottom Settlement map in a tank with 6 columns under product load.*
*Left: scatter plot. Right: interpolated contour plot*

# References


- “Square Robot NDT Payload Validation - API 653 Plate Test Plan and Report” (SRPN 02926)
- “Robotic In-Service AST bottom differential elevation survey” (SRPN 03845R4 - WP)
- “SAMPLE REPORT, PAUT & API 653 5-22-2022”
- “Square Robot EVA Methodology”
- “Tank Questionnaire”

# Appendices

## Appendix I: Square Robot Sample Safe Work Execution Plan (SWEP) for work with Davit or Mobile Crane

(Template to be updated for local and specific requirements and unique job requirements

**SAFE WORK EXECUTION PLAN COVER LETTER**

| | | | |
|---|---|---|---|
| **Client Name:** | | **Date:** | |
| **Project Location:** | | **Project Number:** | |
| **Job Description: Robotic Tank inspection- In service** | | | |
| **Scope of Work:** | | | |
| **Contacts** | **Name** | **Title** | **Cell Phone** |
| **Client Contact** | | | |
| **Square Robot Foreman** | | | |
| **Square Robot QHSE** | Amanda Coughlin | QHSE Manager | |
| **Additional Contacts** | | | |
| | | | |
| **Subcontractors (If Applicable)** | | | |
| | | | |
| | | | |

| | | | |
|---|---|---|---|
| | | | |

Safe Work Execution Plan Summary

# Phase 1: Prepare Jobsite for Robotic Inspections

## Step 1: Arrival & Mobilization

### Task 1: Security clearance and drive to project site

**Action 1: Provide badges and documents to gain access to the facility.**

### Task 2: Parking near Tank

**Action 1: Drive to tank to park vehicle close to tank stairs.**

## Step 2: Unload Trailer

### Task 1: Remove Robot from Van

**Action 1: Crew members unload robots from Van**

### Task 2: Remove equipment from van

**Action 1: Remove toolbox, davit, and generator from van**

## Step 3: Workstation Set-Up

### Task 1: Establish Power to Workstation

**Action 1: Place generator in 3’ x 3’ containment**

**Action 2: Connect grounding wire to generator & approved tank ground**

**Action 3: Fill generator with fuel**

**Action 4: Connect trailer power cord to generator**

**Action 5: Turn on generator and power van**

**Action 6: Connect computers and communications**

**Action 7: Establish communication with robots**

# Phase 2: Robot Inspection Operations

## Step 4: Pre-Launch Set-up

### Task 1: Equipment to Roof

Action 1: Lift job box, temporary barricade, davit crane, and robot to the roof

Action 2: Walk up and down the stairway

Action 3: Run and layout fiber optic communications cable from the roof to the trailer

### Task 2: Pre-dive Checklist

Action 1: Fill out pre-dive checklist for robot
Action 2: Establish communication and test robot to ensure function properly before launch.

### Task 3: Lift Robot to Roof

Action 1: Lift robot to roof with Bocker, Mobile Crane or other means described in the JSA

### Task 4: Ensure Respiratory equipment is set up

Action 1: Ensure Fresh air is functioning, and masks are fit on team

Action 2: Establish communication and plan with the bottle watch personnel

## Step 5: Robot Launch

### Task 1: Connect Robot to Mobile Crane/ Davit

Action 1: Connect robot to mobile crane or davit via lock latch mechanism

Action 2: Connect robot to fiber optic tether

Action 3: Remove robot from cradle

Action 4: Fill out launch checklist to this step

### Task 2: Robot Launching and Ensuring Bond Continuity

Action 1: Transfer robot to be centered over manway

Action 2: Remove manway cover

Action 3: Bond mobile crane to manway flange

Action 4: Test bonding wire continuity throughout the entire process of lowering the robot through the vapor zone.

Action 5: Finish launch checklist

Action 6: Lower robot into product until robot is fully submerged below surface of product

Action 7: Remove lock latch via quick-release wire

Action 8: Lower robot to the tank bottom using the tether

#### Action 9: Place emissions cover over manway opening for robot operations

## Step 6: Robot Operations

### Task 1: Monitor Robot from Operations Van

#### Action 1: Conduct inspection missions from the workstation

### Task 2: Tether Management

#### Action 1: At times during certain missions the tether will need to be managed from the roof

#### Action 2: Walk up and down the stairway

## Step 7: Robot Recovery

### Task 1: Monitor Robot from Operations workstation

#### Action 1: Remove emissions cover

#### Action 2: Pull robot up utilizing fiber optic tether

#### Action 3: Connect lock latch to robot just below the surface of the product

#### Action 4: Utilize mobile crane or davit to pull robot out of the tank

#### Action 5: Hold robot at certain points to drip off excess product while wiping down robot with absorbent towels.

#### Action 6: Place manway cover over opening once robot has been recovered

### Task 2: Robot Cleaning

#### Action 1: Transfer suspended robot over 4’ x 4’ containment

#### Action 2: Wipe down robot with absorbent towels for decontamination

#### Action 3: Remove tether and lock latch

#### Action 4: Place large trash bag around the robot

#### Action 5: Reinstall robot into service cart

#### Action 6: Remove lock latch and tether

### Task 3: Crane Robot from Roof to Ground

#### Action 1: Connect robot for crane lift to ground level

#### Action 2: Walking down the stairway

#### Action 3: Finish any final cleaning at ground level

# Phase 3: Prepare Jobsite for End of Day

## Step 8: Project Site Demobilization

### Task 1: Pack-up

#### Action 1: Disconnect power

#### Action 2: Pack tools and equipment back into the van

#### Action 3: Lock up trailer/ van

### Task 2: Robot Charging

#### Action 1: Place robot in vehicle for charging

#### Action 2: Drive to Charging Area

#### Action 3: Unload robot for charging

#### Action 4: Connect robot to charging box

Safe Work Execution Plan

**OVERALL PROJECT SCOPE OF WORK: (Overall Project Scope of Work)**

| | | | |
|---|---|---|---|
| **PHASE 1** | **Prepare Jobsite for Robotic Inspection** | | |
| | **STEP 1** | **Arrival & Mobilization** | |
| | | **TASK 1** | **Security clearance and drive to project site** |

| Actions | Hazards Present During the Associated Action | Actions to be Taken to Protect Personnel and Address Each Hazard Identified |
|---|---|---|
| 1. Provide badges and documents to gain access to the refinery | 1.1. Provide badges and documents to gain access to the refinery | 1.1.1. Provide badges and documents to gain access to the refinery |
| | **TASK 2** | **Parking near Tank** |

| | | |
|---|---|---|
| 1. Permitting & JSA | 1.1. Not being authorized to work.<br>1.2. Not having a clear understanding of the equipment's condition. | 1.1.1 Conduct job walk with Operations to review the condition of the equipment/work area and associated hazards.<br>1.1.2 All crew members to review Work Permit prior to beginning work.<br>1.1.3 Perform JSA or similar activity.<br>1.1.4 Obtain Operations Authorization on Work Permit. |

| | | |
|---|---|---|
| 2. Drive to tank to park | 2.1. Hitting objects or equipment enroute or during parking | 2.1.1 Utilize spotters during backing or positioning large equipment.<br>2.1.2 While operating any motorized equipment, seat belt shall be worn. |
| STEP 2 | Unload Trailer | |
| | TASK 1 | Remove Robot from Van |

| | | |
|---|---|---|
| 1. Crew members to unload robots from van | 1.0 Cuts / Pinch Cuts / Pinch Points / Line of Fire<br>1.1 Ergonomics – awkward position<br>1.2 Heavy equipment lifting | 1.0 Ensure that all personnel are wearing proper impact & cut resistant gloves<br>1.1 Use proper lifting techniques while moving heavy objects. Lift with our legs and avoid straining or twisting.<br>1.2 Team-lift = Get coworkers help with awkward loads |
| | TASK 2 | Remove Equipment from Van |
| 1. Remove toolbox, davit, and generator from van | 1.1 Cuts / Pinch Cuts / Pinch Points / Line of Fire<br>1.2 Ergonomics – awkward position<br>1.3 Heavy equipment lifting | 1.1 Ensure that all personnel are wearing proper impact & cut resistant gloves<br>1.2 Use proper lifting techniques while moving heavy objects. Lift with our legs and avoid straining or twisting.<br>1.3 Team-lift = Get coworkers help with awkward loads |
| STEP 3 | Workstation Setup | |
| | TASK 1 | Establish Power to Workstation |
| 1. Place generator in containment mat | 1.0 Line of Fire / Pinch Points | 1.1 Ensure that all personnel are wearing proper impact & cut resistant gloves<br>1.2 Use wheels and handle that come with generator |
| 2. Connect grounding wire to generator & approved tank ground | 2.1 Pinch Points<br>2.2 Electrical shock | 2.1 Ensure that all personnel are wearing proper impact & cut resistant gloves<br>2.2 Ensure cables are in good condition and grounding is suitable |
| 3. Fill generator with fuel | 3.1 Gasoline Exposure<br>3.2 Fire Risk | 3.1 Wear chemical resistant gloves and goggles during cleaning. Place absorbent rags in approved trash bag for on site disposal<br>3.2 Ensure approved fire extinguisher is easily accessible |
| 4. Connect trailer power cord to generator | 4.1 Pinch Points<br>4.2 Electrical Shock | 4.1 Ensure that all personnel are wearing proper impact & cut resistant gloves<br>4.2 Inspect all electrical cords for damage prior to use. GFCI switches shall be utilized on all electrical cords |

| | | |
|---|---|---|
| 5. Turn on generator and power on trailer | **5.1** Electrical Shock | 5.1 Inspect all electrical cords for damage prior to use. GFCI switches shall be utilized on all electrical cords |
| 6. Connect computers and communications | 6.1 Electrical Shock | 1.1 Inspect all electrical cords for damage prior to use. GFCI switches shall be utilized on all electrical cords |
| 7. Establish communication with robots | 7.1 Electrical Shock | 7.2 Inspect all electrical cords for damage prior to use. GFCI switches shall be utilized on all electrical cords |

## PHASE 1 Robot Inspection Operations

### STEP 4 Pre-Launch Setup

#### TASK 1 Crane Equipment to the roof

| Actions | Hazards Present During the Associated Action | Actions to be Taken to Protect Personnel and Address Each Hazard Identified |
|---|---|---|
| 1. Lift job box, temporary barricade, davit crane, and robot to the roof | 1.1 Overhead Loads<br>1.2 Line of Fire<br>1.3 Static<br>1.4 Pinch points or stray current for crane operations | 1.1 Utilize spotters during crane operations of large equipment<br>1.2 Do not stand beneath a load<br>1.3 Ensure that all personnel are wearing proper impact & cut resistant gloves<br>1.4 Monitor crane ground with multimeter for conductivity |
| 2 Walk up staircase to roof | 2.1 Slips, Trips and falls | 2.1 Take time to go up and down staircases and watch your step. Keep at least one hand on the rail and use three points of contact while climbing up or down staircase. Keep eyes on path and pay attention to surroundings |
| 3 Run and layout fiber optic communications cable from the roof to the van | 3.1 Overhead hazard<br>3.2 Pinch Points | 3.1 Constant communication with ground level while lowering fiber optic cable<br>3.2 Ensure that all personnel are wearing proper impact & cut resistant gloves |
| | **TASK 2** | **Pre-Dive Checks** |
| 1. Fill out pre-dive checklist for robot | 1.1 Line of Fire | 1.1 Be aware of surroundings and other work in vicinity |
| 2. Establish communication and make sure robot is functioning properly before launch. | 2.1 Line of Fire | 2.1 Be aware of surroundings and other work in vicinity |
| | **TASK 3** | **Lift Robot to Roof** |

| Actions | Hazards Present During the Associated Action | Actions to be Taken to Protect Personnel and Address Each Hazard Identified |
|---|---|---|
| 1. Lift robot to roof with Bocker, Mobile Crane or other means described in the JSA | 1. Overhead Loads<br>1.1. Line of Fire<br>1.2. Pinch points | 1.1 Utilize spotters during crane operations of large equipment<br>1.1. Do not stand beneath a load<br>1.2. Ensure that all personnel are wearing proper impact & cut resistant gloves |
| | **TASK 4** | **Ensure Respiratory equipment is set up** |
| 1. Ensure Fresh air is functioning, and masks are fit on team | 1.1 Potential exposure to Nitrogen<br>1.2 Tangled air lines<br>1.3 Improper Bottle Watch/management<br>1.4 O2 supply inadequate | 2.2 Wear mask properly when manway is open<br>2.3 Ensure lines are not in the path of travel<br>2.4 Ensure training is up to date for bottle watch<br>2.5 Ensure full bottle before beginning the job |
| **STEP 5** | **Robot Launch** | |
| | **TASK 1** | **Connect Robot to Mobile Crane** |
| 1. Connect robot to mobile crane via lock latch mechanism | 1.1 Pinch Points | 1.1 Ensure that all personnel are wearing proper impact & cut resistant gloves |
| 2. Connect robot to fiber optic tether | 2.1 Pinch Points | 2.1 Ensure that all personnel are wearing proper impact & cut resistant gloves |
| 3. Remove robot from cradle | 3.1 Pinch Points<br>3.2 Slips, Trips and Falls | 3.1 Ensure that all personnel are wearing proper impact & cut resistant gloves<br>3.2 Keep eyes on path and pay attention to surroundings and take time plan route to next area. |
| 4 Fill out launch checklist to this step | 4.1 Line of Fire | 4.1 Be aware of surroundings and other work in vicinity |
| | **TASK 1** | **Robot Launching** |
| 1. Transfer robot to be centered over manway | 1.1 Pinch Points<br>1.2 Line of fire<br>1.3 Loss of Communication | 1.1 Ensure that all personnel are wearing proper impact & cut resistant gloves.<br>1.2 Be aware of surroundings and other work in vicinity. Do not be between the load and a static point or fixture<br>1.3 Ensure line of sight with crane operator and designate signalman in the event that communications are lost |
| 2 Remove manway cover | 2.1 Pinch Points<br>2.2 Open manway with fall potential | 2.1 Ensure that all personnel are wearing proper impact & cut resistant gloves<br>2.2 Install temporary barricade to prevent accidental entry in the manway |

| Actions | Hazards Present During the Associated Action | Actions to be Taken to Protect Personnel and Address Each Hazard Identified |
|---|---|---|
| | | 2.3 100% tie off during manway being open for fall prevention into open manway |
| 3 Bond mobile crane to manway flange | 3.1 Pinch Points | 3.1 Ensure that all personnel are wearing proper impact & cut resistant gloves |
| 4 Test bonding wire continuity with a multimeter throughout the entire process of lowering the robot through the vapor zone | 4.1 Static Charges | 4.1 Ensure that bonding procedures are appropriately adhered to prior to the testing protocol. Continuous conductivity monitoring during crane operations |
| 5 Finish launch checklist | 5.1 Line of Fire | 5.1 Be aware of surroundings and other work in vicinity |
| 6 Lower robot into product until robot is fully submerged below surface | 6.1 Pinch Points | 6.1 Ensure that all personnel are wearing proper impact & cut resistant gloves |
| 7 Remove lock latch via quick-release wire | 7.1 Pinch Points | 7.1 Ensure that all personnel are wearing proper impact & cut resistant gloves |
| 8 Lower robot to the tank bottom using the tether | 8.1 Cuts and abrasions | 8.2 Ensure that all personnel are wearing proper impact & cut resistant gloves |
| 9 Place emissions cover over manway opening for robot operations | 9.1 Pinch Points | 8.1 Ensure that all personnel are wearing proper impact & cut resistant gloves |
| **STEP 6** | **Robot Operations** | |
| | **TASK 1** | **Monitor Robot from Operations Van** |
| 1. Conduct inspection missions from the workstation | 1.1 Possible $CO_2$ emissions from the generator | 1.1 Continuous air monitoring near trailer doorways<br>1.2 Be aware of changing wind directions and move generator appropriately to prevent generator emissions from entering trailer |
| | **TASK 2** | **Tether Management** |
| 1. Walking up and down the stairway | 1.1 Slips, Trips and falls | 1.1 Take time to go up and down staircase and watch your step. Keep at least one hand on the rail and use three points of contact while climbing up or down staircase. Keep eyes on path and pay attention to surroundings and take time plan route to next area. |
| **STEP 6** | **Robot Recovery** | |

| Actions | Hazards Present During the Associated Action | Actions to be Taken to Protect Personnel and Address Each Hazard Identified |
|---|---|---|
| | **TASK 1 Robot Recovery** | |
| 1. Don Respiratory Protection | 1.1 Nitrogen exposure | 1.1 Ensure proper fit and monitoring of LELs. Wear PPE properly and have bottle watch if using fresh air supply |
| 2. Remove emissions cover | 2.1 Pinch Points<br>2.2 Open manway with fall potential | 2.1 Ensure that all personnel are wearing proper impact & cut resistant gloves<br>2.2 100% tie off during manway being open for fall prevention into open manway |
| 3 Pull robot up utilizing fiber optic tether | 3.1 Pinch Points Product exposure from tether<br>3.2 Product dripping from tether | 3.1 Wear appropriate chemical and cut resistant gloves<br>3.2 Wear chemical resistant gloves |
| 4 Connect lock latch to robot just below the surface of the product | 4.1 Pinch Points | 4.1 Ensure that all personnel are wearing proper impact & cut resistant gloves |
| 5 Utilize mobile crane to pull robot out of the tank | 5.1 Pinch Points | 5.1 Ensure that all personnel are wearing proper impact & cut resistant gloves |
| 6 Hold robot at certain points to drip off excess product while wiping down robot with absorbent towels | 6.1 Pinch Points<br>6.2 Product Exposure<br>6.3 Product splash into eye area | 6.1 Ensure that all personnel are wearing proper impact & cut resistant gloves<br>6.2 Wear chemical resistant gloves<br>6.3 Use appropriate eye wear (glasses) during this action item |
| 7 Place manway cover over opening once robot has been recovered | 7.1 Pinch Points | 7.1 Ensure that all personnel are wearing proper impact & cut resistant gloves |
| | **TASK 2 Robot Cleaning** | |
| 1. Transfer suspended robot over 4' x 4' containment | 1.1 Pinch points<br>1.2 Line of Fire | 1.1 Ensure that all personnel are wearing proper impact & cut resistant gloves<br>1.2 Be aware of surroundings and other work in vicinity. Do not be between the load and manway opening. |
| 2 Wipe down robot with absorbent towels for decon | 2.1 Product Exposure | 2.1 Wear Tyvek suit if SDS calls for it, chemical resistant gloves and safety glasses during cleaning. Place absorbent rags in approved trash bag |
| 3 Remove tether and lock latch | 3.1 Pinch Points | 3.1 Ensure that all personnel are wearing proper impact & cut resistant gloves |
| 4 Place large trash bag around robot | 4.1 Line of Fire | 4.1 Be aware of surroundings and other work in vicinity |
| 5 Re-install robot into service cart | 5.1 Pinch Points | 5.1 Ensure that all personnel are wearing proper impact & cut resistant gloves |

| Actions | Hazards Present During the Associated Action | Actions to be Taken to Protect Personnel and Address Each Hazard Identified |
|---|---|---|
| 6 Remove lock latch and tether | 6.1 Pinch Points | 6.1 Ensure that all personnel are wearing proper impact & cut resistant gloves |
| | **TASK 3** | **Crane Robot from Roof to Ground** |
| 1. Connect robot for crane lift to ground level | 1.1 Overhead Loads<br>1.2 Line of Fire<br>1.3 Pinch points | 1.1 Utilize spotters during crane operations of large equipment<br>1.2 Do not stand beneath a load<br>1.3 Ensure that all personnel are wearing proper impact & cut resistant gloves |
| 2 Walking down the stairway | 2.1 Slips, Trips and falls | 2.1 Take time to go up and down staircase and watch your step. Keep at least one hand on the rail and use three points of contact while climbing up or down staircase. Keep eyes on path and pay attention to surroundings and take time plan route to next area. |
| 3 Finish any final cleaning at ground level | 3.1 Product Exposure | 3.1 Wear chemical resistant gloves and safety glasses during cleaning. Place absorbent rags in approved trash bag |

*This section shall be used to include work that may be necessary but not addressed above.* ***COPY*** *and* ***PASTE*** *this entire section, including the signature section, to the blank area below* ***prior*** *to completing this section. This will prepare the document for the next change, if any. Repeat with each successive change.*

| | | |
|---|---|---|
| **PHASE 1** | **Prepare Jobsite for End of Day** | |
| | **STEP 1** | **Project Site Demobilization** |
| | **TASK 1** | **Pack up Jobsite** |

| | Actions | Hazards Present During the Associated Action | Actions to be Taken to Protect Personnel and Address Each Hazard Identified |
|---|---|---|---|
| | 1. Disconnect power | 1.1 Pinch points | 1.1 Ensure that all personnel are wearing proper impact & cut resistant gloves |
| | 2 Pack tools and equipment back into the van | 2.1 Cuts / Pinch Points / Line of Fire<br>2.2 Ergonomics – awkward position<br>2.3 Heavy equipment lifting | 2.1 Ensure that all personnel are wearing proper impact & cut resistant gloves<br>2.2 Use proper lifting techniques while moving heavy objects. Lift with our legs and avoid straining or twisting.<br>2.3 Team-lift = Get coworkers help with awkward loads |
| | 3 Lock up trailer/ van | 3.1 Pinch points | 3.1 Ensure that all personnel are wearing proper impact & cut resistant gloves |
| | | **TASK 2** | **Robot Charging** |
| | 1. Place robot in truck for charging | 1.1 Cuts / Pinch Points / Line of Fire<br>1.2 Ergonomics – awkward position<br>1.3 Heavy equipment lifting | 1.1 Ensure that all personnel are wearing proper impact & cut resistant gloves<br>1.2 Use proper lifting techniques while moving heavy objects. Lift with our legs and avoid straining or twisting.<br>1.3 Team-lift = Get coworkers help with awkward loads |
| | 2 Drive to Charging Area | 2.1 Hitting objects or equipment enroute or during parking | 2.1 Utilize spotters during backing or positioning large equipment.<br>2.2 While operating any motorized equipment, seat belt shall be worn. |
| | 3 Unload robot for charging | 3.1 Cuts / Pinch Points / Line of Fire<br>3.2 Ergonomics – awkward position<br>3.3 Heavy equipment lifting | 3.1 Ensure that all personnel are wearing proper impact & cut resistant gloves<br>3.2 Use proper lifting techniques while moving heavy objects. Lift with our legs and avoid straining or twisting.<br>3.3 Team-lift = Get coworkers help with awkward loads |
| | 4 Connect robot to charging box | 4.1 Pinch Points | 4.1 Ensure that all personnel are wearing proper impact & cut resistant gloves |

# Appendix II: Square Robot Job Safety Analysis (JSA)

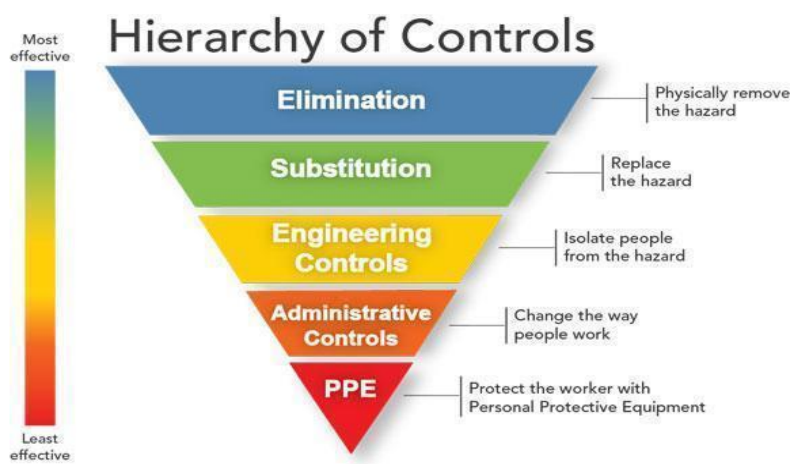
(Note - JSA is illustrative and will be in electronic form on location)

<Location>

Tank <Number>

<Project Number>

<Date>



**CONTENTS**

square ROBOT

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Marlborough, MA 01752

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e: info@squarerobots.com

## General Project Information

| | | | |
|---|---|---|---|
| **Client Name:** | | **Date:** | |
| **Project Location:** | | **Project Number:** | |
| **Job Description:** | | | |
| **Contacts** | **Name** | **Title** | **Cell Phone** |
| **Client Contact** | | | |
| **Square Robot Foreman** | | | |
| **Square Robot Safety Representative** | | | |
| **Additional Contacts (If Applicable)** | | | |
| | | | |
| **Subcontractors (If Applicable)** | | | |

## Hazard Identification

| Potential Hazards | | Mitigation and Controls | | |
|---|---|---|---|---|
| **Motion** | **Chemical** | **Hazard Controls (Engineering and Administrative)** | | |
| ☐ Vehicle Movement | ☐ Explosive / Flammable Vapors | ☐ Work Permits | ☐ Ignition Source Controls | ☐ Break Rotation |
| ☐ Limited Mobility (confined space) | ☐ Carcinogen Compound | ☐ PPE Program | ☐ Gas Monitoring | ☐ Temporary Lighting |
| ☐ Equipment Movement | ☐ Toxic Compounds | ☐ Warning Signs | ☐ Safety Data Sheets | ☐ Isolation of Hazardous Energy |
| ☐ Water / Wind Movement | ☐ Corrosive Compound | ☐ Markers | ☐ Scaffolding | ☐ Equipment Inspections |
| ☐ Body Positioning / Ergonomics | ☐ Reactive Compounds | ☐ Attendants (Confined Space) | ☐ Parking Plans | ☐ Bonding |
| ☐ Manual Lifting | ☐ Pyrophoric Material | ☐ Barricades | ☐ Equipment Staging Plans | ☐ Grounding |
| ☐ Shackles/ Lifting eyes | ☐ Irritants | ☐ Housekeeping | ☐ Essential Personnel Only | ☐ Other: |
| ☐ Nylon/ Metal Slings | ☐ Environmental Risk | **Safety Controls (Personal Protective Equipment)** | | |
| ☐ Other: | ☐ Other: | ☐ Hard Hat | ☐ Cut Resistant Gloves (A3 min) | ☐ Respirator / Cartridges |
| **Gravity** | **Pressure** | ☐ Safety Shoes | ☐ Chemical Gloves | ☐ FR Clothing / Rain Gear |
| ☐ Overhead Work | ☐ Piping | ☐ Safety Gloves | ☐ Hearing Protection | ☐ LEL Monitor |
| ☐ Falling or Dropped Objects | ☐ Cylinders | ☐ Face Shield | ☐ Body Harness / Fall Protection | ☐ H2S Monitor |
| ☐ Excavation | ☐ Vessels / Tanks | ☐ Goggles | ☐ Other: | |
| ☐ Collapsing roof/equipment | ☐ Hoses | **Safety Equipment** | | |
| ☐ Elevated / Uneven work surfaces | ☐ Other: | ☐ Fire Extinguishers | ☐ Personal/ Area Monitors | ☐ Caution Tape |
| ☐ Open holes | **Radiation** | ☐ Fire Retardant Tarps | ☐ Tag Lines/ Push-Pull Poles | ☐ E-Stops |
| ☐ Work at Heights | ☐ Lighting | ☐ Locks and Tags (LOTO) | ☐ Safety Cable | ☐ Safety Barricade |
| ☐ Other: | ☐ Welding arc / flash | ☐ Gas Detectors | ☐ Exclusion Zone | ☐ Other: |
| | ☐ Sunlight | | | |

| | | | | |
|---|---|---|---|---|
| **Biological** | **Temperature** | **Emergency / Contingency Plans** | | |
| ☐ Animals / Insects | ☐ Ignition Source / Static | ☐ Emergency Evacuation Plans | ☐ Incident Reporting Procedure | ☐ CPR & First Aid |
| ☐ Bacteria / Viruses | ☐ Hot or Cold Surfaces | ☐ Rescue Planning | ☐ Rescue Planning | ☐ Other: |
| ☐ Bloodborne Pathogens | ☐ Hot or Cold Gases | **Certification Requirements** | | |
| ☐ Other | ☐ Extreme weather Conditions | ☐ Qualified Crane Operator | ☐ Fire Watch | ☐ Respiratory |
| **Mechanical** | ☐ Other: | ☐ Qualified Rigger | ☐ Equipment Operator | ☐ Fit Test |
| ☐ Rotating Equipment | **Electrical** | ☐ Qualified Signalman | ☐ Qualified Forklift Operator | ☐ Other |
| ☐ Power / Hand tools | ☐ Power lines (above / below) | ☐ Scaffold Inspector | ☐ Confined Space Attendant | |
| ☐ Pneumatic Tools | ☐ Energized Equipment | **Safe Work Practices** | | |
| ☐ Pinch Points | ☐ Batteries | ☐ Lock, Tag, and Try / LOTO | ☐ Electrical Safe Work | ☐ Respiratory Protection |
| ☐ Vibration | ☐ Static Charges | ☐ Never Bypass Safety Controls | ☐ Hot Work | ☐ Stop Work Authority |
| ☐ Other | ☐ Wiring | ☐ Confined Space | ☐ Mechanical Lifting and Rigging | ☐ Working at Heights |
| **Sound** | ☐ Grounding | ☐ Driving | ☐ Line of Fire | ☐ Life Saving Rules |
| ☐ Equipment Noise | ☐ Rectifiers | **Environmental Equipment** | | |
| ☐ Impact Noise | ☐ Slips, Trips, or Falls | ☐ Absorbent Pads | ☐ Waste Drums | ☐ Spill Kit |
| ☐ Venting Noise | ☐ Adequate Lighting | ☐ Containment Pans | ☐ Spill Containment | ☐ Other: |
| ☐ Communication (Sim-Ops) | ☐ Other: | ☐ Spill Response Plan | | |
| ☐ Communication (Language) | | | | |

# Risk Matrix

When Listing, use the corresponding square for the JSA (i.e. 2B, 4A, etc)

| Consequence | | People | Environment | Asset | Reputation | Probability | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | A | B | C | D | E |
| | | | | | | Never heard of in industry | Heard of in industry | Happened in company or more than once per year in industry | Happened at the location or more than once per year in company | Happened more than once per year at the location |
| | 1 | Slight injury (First Aid) or health effect | No effect, secondary containment effective | <$5,000 | No Report to Regulator | Low | Low | Low | Low | Low |
| | 2 | Minor injury (Recordable) or health effect | Short-term effect | >$5,000 | No / Minor Public Notice | Low | Low | Low | Medium | Medium |
| | 3 | Severe injury (LTI) or multiple minor injuries | Moderate-term effect | >$50,000 | Local Interest | Low | Low | Medium | Medium | High |
| | 4 | Permanent disability, death, or severe injury | Widespread medium to long-term effect | >$500,000 | National Attention | Low | Medium | Medium | High | High |
| | 5 | Multiple deaths or permanent disabilities | Permanent widespread effect | >$5m | International Impact | Medium | Medium | High | High | High |

## Job Safety Analysis

| Job Steps | Potential Risk | Hazards | Controls | Residual Risk |
|---|---|---|---|---|
| General Setup and Takedown | | Biological- snakes, insects<br><br>Pinch Points, punctures or cuts<br><br>Environment- uneven surfaces, steep stairs, slips trips or falls<br><br>Body Ergonomics- Lifting, twisting, positioning<br><br>Electrical shock due to wires, extension cords, or cables | Use caution when moving debris- PPE (boots, glasses, and gloves) to be utilized. Bug spray available if needed.<br><br>Impact/Cut resistant gloves of ANSI L3 or higher<br><br>Wear Boots with ankle protection, Use 3 points of contact when necessary and utilize cribbing and ramps<br><br>Use team lift with proper body mechanics<br><br>Ensure proper storage of electrical components, always check electrical cords before use. GFCI switches shall be used on all electrical cords | |
| Fueling of Equipment (vehicles, generators) | | Chemical Exposure to hydrocarbons through fumes or accidental discharge<br><br>Thermal Flash exposure or potential static charges<br>Heavy Lifting- Manual lifting<br><br>Line of fire | Ensure space is given for ventilation, have chemical gloves if needed. Spill pads available with a nearby spill kit identified<br><br>Shut off the generator for 15 min prior to filling. Use two workers if equipment is elevated or in an awkward position for filling. Do not overfill equipment. Bond prior to filling. Always fill containers on the ground level if possible. Know where the fire extinguishers are.<br><br>Be aware of surroundings, Ensure that you are in a safe place away from traffic and from being pinned between 2 solid objects. | |
| Loading or unloading or truck and materials | | Overhead power lines/cables<br><br>Heavy loads, lifting/rigging of equipment | Access areas and routes for adequate clearance for equipment. Obey all speed limits, no cell phone use while driving<br><br>Utilize spotters during backing or positioning large equipment. Inspect slings and rigging before use. Ensure that all personnel are | |

| Job Steps | Potential Risk | Hazards | Controls | Residual Risk |
|---|---|---|---|---|
| | | Cuts, punctures, pinch points<br><br>Repetitive Motion, strains, sprains<br><br>Sloping terrain, uneven ground, limited access to work areas<br><br>Vehicle Incidents- Rolling, crushing, being hit<br>Traffic- External | wearing proper impact & cut resistant gloves. Tag lines or push pull poles to be used to reduce hands on load<br><br>Use proper lifting techniques while moving heavy objects. Lift with your legs and avoid straining or twisting. Use team lift with anything over 50 lbs<br><br>Wear Boots with ankle protection, Use 3 points of contact when necessary and utilize cribbing and ramps. Be aware while walking around muddy or rutted areas. Avoid berms / steep areas.<br><br>Be aware of surroundings, Ensure that you are in a safe place away from traffic and from being pinned between 2 solid objects. | |
| Staging of equipment | | Heavy loads, lifting/rigging of equipment<br>Cuts, punctures, pinch points<br><br>Repetitive Motion, strains, sprains<br><br>WAH, ladders, elevated work surfaces<br><br>Chemical Exposure- Fumes, lithium batteries, leaks | Utilize spotters during backing or positioning large equipment. Inspect slings and rigging before use. Ensure that all personnel are wearing proper impact & cut resistant gloves. Tag lines or push pull poles to be used to reduce hands on load<br><br>Use proper lifting techniques while moving heavy objects. Lift with your legs and avoid straining or twisting. Use team lift with anything over 50 lbs<br><br>Ensure training is up to date, if using harness- inspect before use and date tag. Use 3 points of contact and always secure tools when working at heights. Ensure the area is secured from those working below you.<br><br>Place spill containment under generator, check for leaks prior to powering up, ensure adequate ventilation of equipment | |

| Job Steps | Potential Risk | Hazards | Controls | Residual Risk |
|---|---|---|---|---|
| Robotic Inspection Operations | | Ergonomics- Manual Lifting, pulling, strains<br><br>Sloping terrain/ WAH, ladders, elevated work surfaces<br><br>Chemical exposure through fumes, drips from residue on robot | Use proper lifting techniques while moving heavy objects. Lift with your legs and avoid straining or twisting. Use team lift with anything over 50 lbs<br><br>Wear Boots with ankle protection, Use 3 points of contact when necessary and utilize cribbing and ramps. Be aware while walking around muddy or rutted areas. Use fall prevention/protection in areas with nor railing. Place a temporary barricade over the roof opening. Use a temporary kickboard around opening to prevent tools from falling into tank.<br><br>Drip dry robot during recovery lift with hoist. Place absorbent pads around the opening and under hoist for stray drips. Wipe robot while exiting the opening. Place a plastic bag under the robot prior to lift for overnight charging. | |
| | | | | |
| | | | | |

## JSA Signature Page-

| Acceptance | JSA Update / Revision Date |
|---|---|
| | |

## Managing Subcontractors

- Not Applicable

- ISNet Grade and OQ requirements for subcontractors

## Training Requirements

All Field Personnel have the following training:snp

- TWIC Card
- Basic Orientation- through a Reciprocal Safety Council
- Basic Rigger Training (29 CFR 1926.753)
- Fall Protection training with annual assessments (29 CFR 1926.503)
- Work at Heights around mobile crane (29 CFR 1926.501)
- Ladder and Scaffolding Safety/ Dropped Objects (29 CFR 1926.106 & 29 CFR 1926.454)
- Confined Space (29 CFR 1910.146)
- MARSEC
- First aid/ CPR and BBP (29 CFR 1910.1030)
- Electrical Safety and LOTO (29 CFR 1926.404 & 29 CFR 1910.147)
- Fire Prevention and Control Training (29 CFR 1910.157)
- Hazard Communication (29 CFR 1910.1200)
- RCRA Spill Response Training (40 CFR Part 282)
- Hearing Conservation training (29 CFR 1910.95)
- Lifesaving Rules- based on IOGP guidelines
- H2S, Benzene, Asbestos, HF, and Nitrogen trainings
- Process Safety Management and Contractor Responsibilities (29 CFR 1926.64)
- Ergonomics and Injury Prevention Training (CalOSHA T8 CCR 3203)
- Hazard Identification and Awareness
- Respiratory Training (29 CFR 1910.134)
- Fit Testing, MEQ and PFT
    - Employees are tested on the following masks if fresh air is needed. We typically rent them out with someone to maintain bottle watch.
        - 3M Full Face 6800
        - North Full Face 5400

## PPE

All Kits include the following and employees are trained on usage and inspection prior to use. Documentation of Annual certifications can be found in EHS Insight or through QHSE Department.

- Fall Protection Harnesses
- 100 ft Lifelines
- 60 ft Retractable Lifelines
- Rope Grabs
- Portable 4 gas monitors
- H2S monitors
- Bump testing Kit
- Spill Containment unit
- Tool Lanyards
- Absorbent Pads
- Lifting Straps
- Radios for Communication
- Chemical Goggles

## Audits and Planned Observations

- Tailgate safety meetings will be performed on a daily basis. JSA will be reviewed each morning prior to commencing any work activities. Daily JSA's required in paper format or through EHS Insight.

## Motor Vehicle Safety

- Licensed Drivers Only.
- Back in Parking, Obey Posted Speed Limits; No Phone Usage While Driving; All Passengers shall always Wear Seat Belts while moving.
- Driving monitors on all company vehicles track speed and locations

## Short Service Employee (SSE) Training and Identification

- All employees new to the industry will be identified with Yellow Hard hats.

## Communication

- We will be communicating with all personnel verbally. We will have intrinsically safe radios for communication between the operations trailer and the crew who will be launching and recovering the vehicle on the tank roof. There must also remain a line of sight in case of communication failure.

## Incident Management

**First Responder from onsite team** (Onsite First Aid and Kit inside Trailer)

| | |
|---|---|
| **First Aid / Minor Treatment Facility** | **Phone** |
| **Clinic's Contact** (Doctor or Professional Medical Provider's Name) | **Phone** |
| **Emergency Medical Treatment Facility** (Local Hospital / Regional Trauma Center) | **Phone**<br>911 |
| **Local Ambulance** (Attach Driving Route to this Plan) | **Phone**<br>911 |
| **Local Law Enforcement** | **Phone**<br>911 |
| **Local Fire Department** | **Phone** |

## First Aid / Minor Medical Directions

## Hospital Directions

# END OF REPORT