

# **NSRP WF&C Panel Meeting**

## **Cooling Suits for Improved Worker Efficiency**

### **NSRP Project No. 15, Mar 2024**

**GDEB Contract 2018-450, Task Order 015**

# Background

- **Shipyards workers are exposed to high temperatures for prolonged periods of time in order to perform critical construction activities.**
  - Welders Jackets/Bib (fire resistant canvas/cloth)
  - Grinding, Lead work, etc. (fire resistant canvas/cloth)
  - Painters Coveralls (fire resistant Tyvek and respirator)
  - Nuclear Work - Anti-Cs Radcon (double Anti-Contamination clothing and respirator)
  - Nuclear Work - Recently shut down area, high rad
  - Electricians (Arc protection gear)
- **This has the potential for workers to experience heat exhaustion/related injuries and adversely affect human performance**






# Current Project Status

- **Current Solution: Air cooled suits**
  - Tether impedes or prohibits use in confined spaces
  - Suits not always suitable for fire safety
- **Project focusing on welding in confined (and very hot) spaces**
  - Workers spend on average 30 minutes to enter, weld, and exit confined spaces
  - Cooling suits not effective over protective garments. Running hoses to nearest outlet impedes workflow leading trades to forgo cooling
- **Newer cooling suits are a potential solution to this problem**







# Suit Down Selection

|         |   |  |   |   |
|---------|---|--|---|---|
| Suit    |  |  |  |  |
| Company | TDA   | Ocean IT   | Nanomics  | Nanomics  |
| Type    | Forced Air<br>Evaporative   | Pump+ice   | Thermoelectric<br>Active Cooling  | Cooled air for<br>respirators   |

- Conducted market survey of likely candidate solutions listed above
- Used specific application and selection criteria to down select solution for testing

# Suit Down Selection



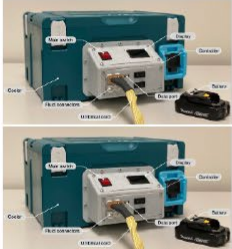







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- **TDA – Base Suit could not all be made of fire retardant material. Concerns of contamination in radcon use case.**
- **Nanomics – Concerns of how system would react to flame or spark. Still interested in technology**
- **Cooled air for respirators – not used in the target site for this project. Will be investigated in subsequent effort.**

# Ocean IT Solution

- High cooling capacity
- Completely fire resistance (including internal tubing)
- Optional smaller capacity for lower cooling needs
- User controllable cooling capacity



|                  | Garment   | Cooling Option A  | Cooling Option B  | Cooling Option C  |
|------------------|---|---|---|---|
| High (200W-300W) |   |   |    |   |
| Medium (125W)    |  |  |   |  |
| Low(50W-80W)     |  |  |  |   |



# Procedure and Equipment

- **2 Welders per day over 10 Days**
  - 20 Total Samples (10 with suit, 10 without)
- **Majority of Data will be collected through Empatica wearable data recorders.**
  - Will record Galvanic skin response, heart rate, heart rate variability, skin temperature, etc.
- **Ambient temperature and Humidity recorded**
- **Pre and Post work survey will be taken for user comfort and perceived effort**
- **Welder body temp will be taken via ear measurement by yard medical team**



# Questions?