



# FY20-FY22 3D Scanning Megaproject (LiDAR Megaproject)

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## Presented By:

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## Participants:

PHD, PD, CD, CR, DD, KPT

NIWC PAC, NPS

NAVAIR



**Keeping our Navy Underway, Combat Ready and Effective**



# 3D Scanning Megaproject Background

**Technology:** The ISEAotF team recognized LiDAR and other 3-D scanning technologies (side scan sonar, photogrammetry, videogrammetry, et al) as game-changing technologies for improving both installation cost and times by eliminating rework.

**Broad Usage:** NSWC PHD, PD, DD, CR, CD, and NIWC PAC have all used LiDAR for various applications and use cases but available data is limited.

**Hi Return on Investment:**

An ROI estimate put together by NSWC PHD, PD, and NIWC PAC estimates cost avoidance between \$1M and \$2.7M for major availabilities, at a cost between \$200k and \$600k depending on level of data collected, distribution, and infrastructure.

**Promise for Future S&T Applications:**

LiDAR has been explored for many current and S&T applications:

1. Topside assessments, signatures
2. Digital Twins – configuration management, health assessments and monitoring, spec drift, training
3. Ship modelling and structural assessments
4. Corrosion identification (leveraging ML)
5. Many others

***Megaproject BLUF: Integrating LiDAR as a core technology for availability planning will generate data sets for a wide range of additional applications, enabling digital transformations and opening up new analysis efforts.***

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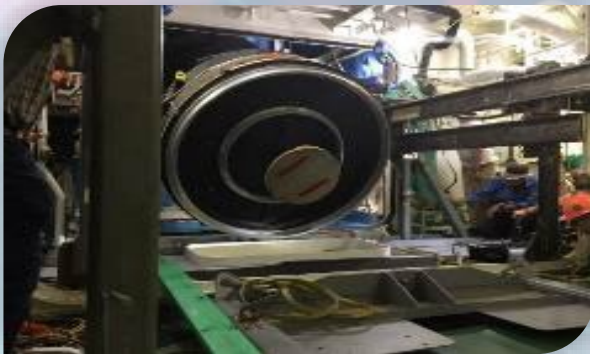
CONVAL Reservist LiDAR Scanning  
at Port Hueneme, CA



# LiDAR / 3D Scanning Technology Challenges

- **Technology**: LiDAR is a new technology to many of the stakeholders in the NR&DE – notably installation and modernization teams, installation design teams (planning yards and others).
- **Data Management**: 3D scanning generates large file sizes that are cumbersome and have challenged usage.
- **Limited Current Demand**: lack of exposure and demand for the largest user of 3D scanning data: installers. Exposure and workforce development is needed at the WFCs, and ROI needs to be demonstrated for program offices.
- **Leadership**: no formal program for 3D scanning exists. Many stovepiped sponsors have funded 3D scanning for targeted use cases (spaces) but there is no single enterprise vision/program or platform perspective.

LiDAR MP will expose the installation community, align disparate efforts, establish a community, and set a vision for a 3D scanning program.



NSWC PD: DDG1001 MTG Removal



NSWC PD: DDG1001  
MTG Removal Planning



NSWC PHD: Software provided  
point to point measurements



NSWC PHD / NPS - SDTS Scan

**3D Scanning offers strong alignment for both in-service and S&T applications**



# 3D Scanning Megaproject Execution BLUF

## Accomplishments and status:

- LPD-22 surge-scanned on FY20 NISE funds / NIWC Overhead
  - ✓ 7,300 Individual Scans
  - ✓ 1.5 TB of data captured
  - ✓ 12-14 TB expected once data has been analyzed
- Drone scans performed to capture topside
- NAVSEA 1DE picked “Virtual Ship Checks” as Use Case 1
  - ✓ Active discussions ongoing with SEA03, SEA04, SEA05, SEA21 on establishing a formal 3D scanning program.
- Data distribution to install community.
  - ✓ Installation Coordinators to redline drawings, and document/report rework and installation issues that will be avoided, and ROI (time savings and \$)
- Retired FFG SINKEX targets 3D scanned in-port, drone scanned
  - ✓ Demonstration of LiDAR and photogrammetry as enabler for Battle Damage Assessment and Repair (BDAR)





# 3D Scanning Megaproject Objectives

## 1. Establish Processes:

- **Collect/Generate a high-quality complete data set of an operational surface combatant:** Demo ability to collect/distribute 3D Scanning data cost-effectively at the Enterprise level. This (GOV owned) data will become an enabler for future research and other applications.

## 2. Capture Enterprise ROI to transition & deploy tech:

- **Assess ROI for Installation and Installation Design:** Collect valuable data on a platform's actual ship's condition, useful for future availability planning and ship modelling efforts, potentially resulting in significant cost savings over the lifetime of the scan data.
- **Assess value for physics-based/FE model digital twins:** Demonstrate the value of platform-level scanning efforts to support the creation of structural digital twins for a wide-range of assessments.
- **Assess value for platform damage assessments:** Explore how the NAVSEA community can leverage the output data of 3D Scanning tools to build models, and estimate platform damage and fatalities after assets experience collisions or casualties for warfighting planning and operational response.

## 3. Establish clear Navy direction for 3D Scanning (establish program requirements):

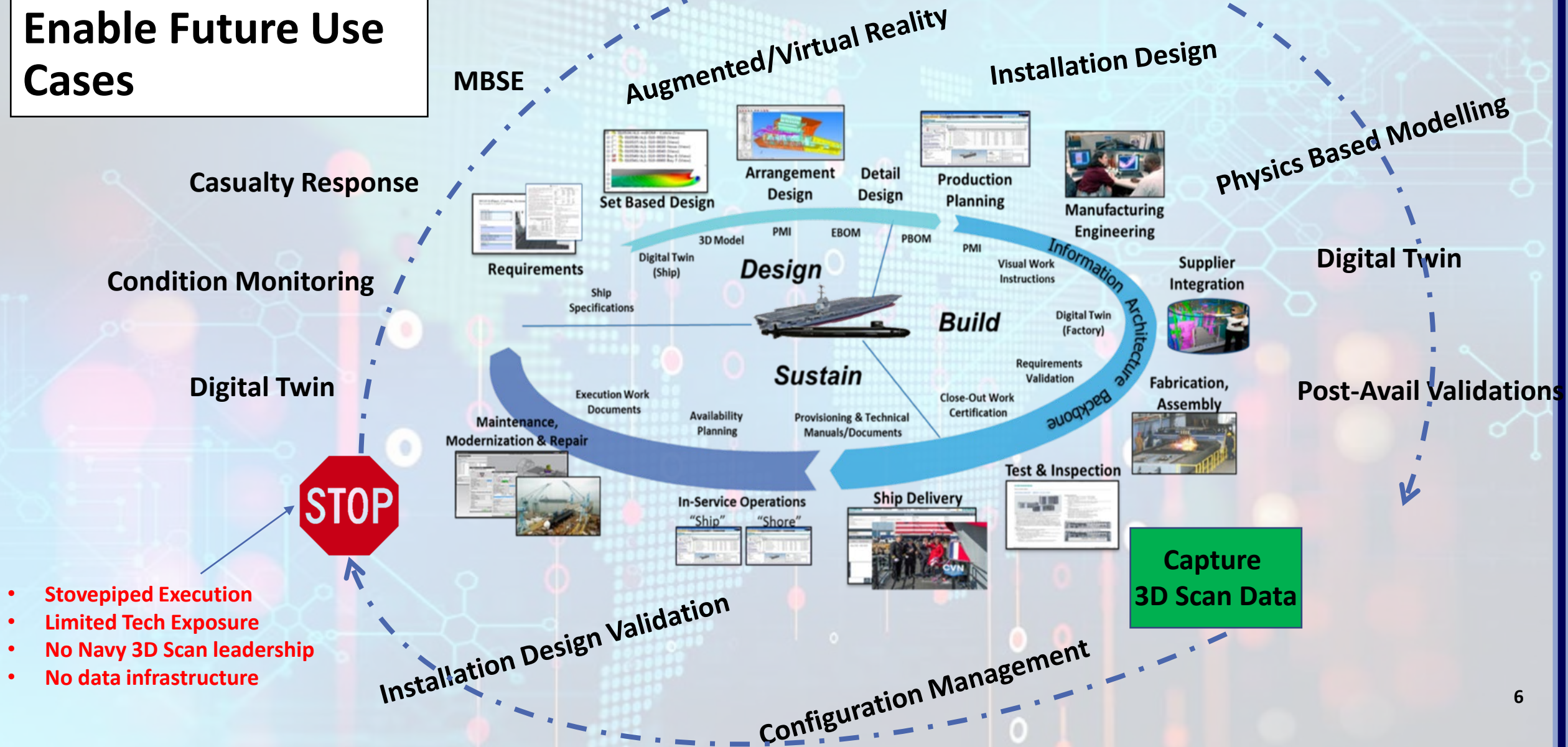
- **Collaboration in support of tech transition:** Bring together the needs of various Warfare Centers and stakeholders, each with a specific use case for 3D Scanning scan technologies. It will enable the utilization of data sets for a multi user purpose, and development of methods and tools resulting in a fully integrated ship model.
- **Assess ability of merging data sets over time:** Leverage and couple the capability of existing production 3D models with newly acquired as-is structural conditions 3D scans to evaluate the ship conditional status.
- **Data Strategy:** Determine best path-forward for data storage, processing, and handling across the NR&DE

## 4. Identify and explore future 3D scan data use cases

- **Assess 3D model alignment with Digital Engineering:** Provide insights on how LiDAR data can be used for capturing metadata for library parts, enabling future integration with MBSE tools, additional analysis processes such as RCS modelling, etc. Many opportunities exist; we need to identify them and build a unified business use case.
- **Digital Twin:** Assess future Digital Twin applications



# Enterprise Vision to Enable Future Use Cases





# 3D Tech Timeline

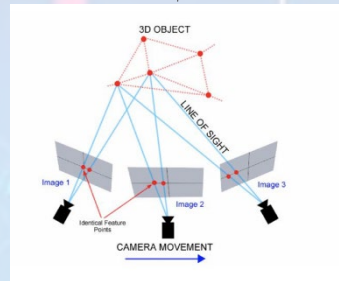
LiDAR



Mobile Devices



Autonomy / Robotics



3D Photogrammetry /  
Videogrammetry



Drone / UAV



UUV Integration /  
Sensor Development  
(Sonar, LiDAR, Optical)

**3D Scanning and aligned technologies are maturing quickly. This MP will inform both near-term execution as well as future use cases.**

## Current State

**Storage:** "Power User" WFC Teams Archive Data through Local RDT&E Network Storage & Portable Hard Drives

**Accessibility:** "Power Users" process data and prepare custom deliverables

**Sharing:** Physically Mail Laptops & Portable Hard Drives with Data



## Cloud Sharing

Explore Cloud Sharing Options

- HPCMP Cloud Storage
- NIWC Pacific Migration of Data to DREN
- NSWC Corona Data Hub



## Strategic Alignment

NAVSEA Standardization

- Define Technical Authority Pyramid
- Develop standards for acceptance of data from planning yards and contractors
- Develop SOPs for Data Management to align with SEA03R's MBPS Environment



## Software Accessibility

Enhance Interaction Capabilities:

- Host SW Tools through HPC Environment
- NIWC Pacific team continue development of data distribution and manipulation tools

## Near-term

**Storage:** Data to NIWC Pacific for Storage on Local Servers

**Accessibility:** "Power Users" request Point Cloud Data as required and "Normal Users" leverage Pickle.jar for basic interaction with data.

**Sharing:** Physically Mail Laptops & Portable Hard Drives with Data. Some data can be shared via DI2E (100 GB limit).

## End State

**Storage:** Align with NOBLE/AWARE Data in Cloud

**Accessibility:** Data accessibility through formalized request process

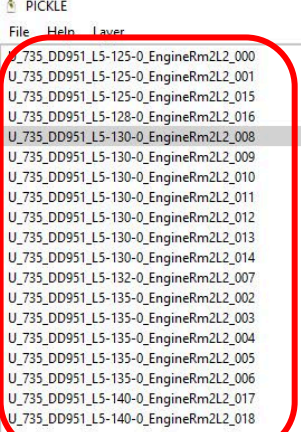
**Sharing:** Streamlined Data distributed across NR&DE Community

**This effort is developing and maturing long-term data requirements**

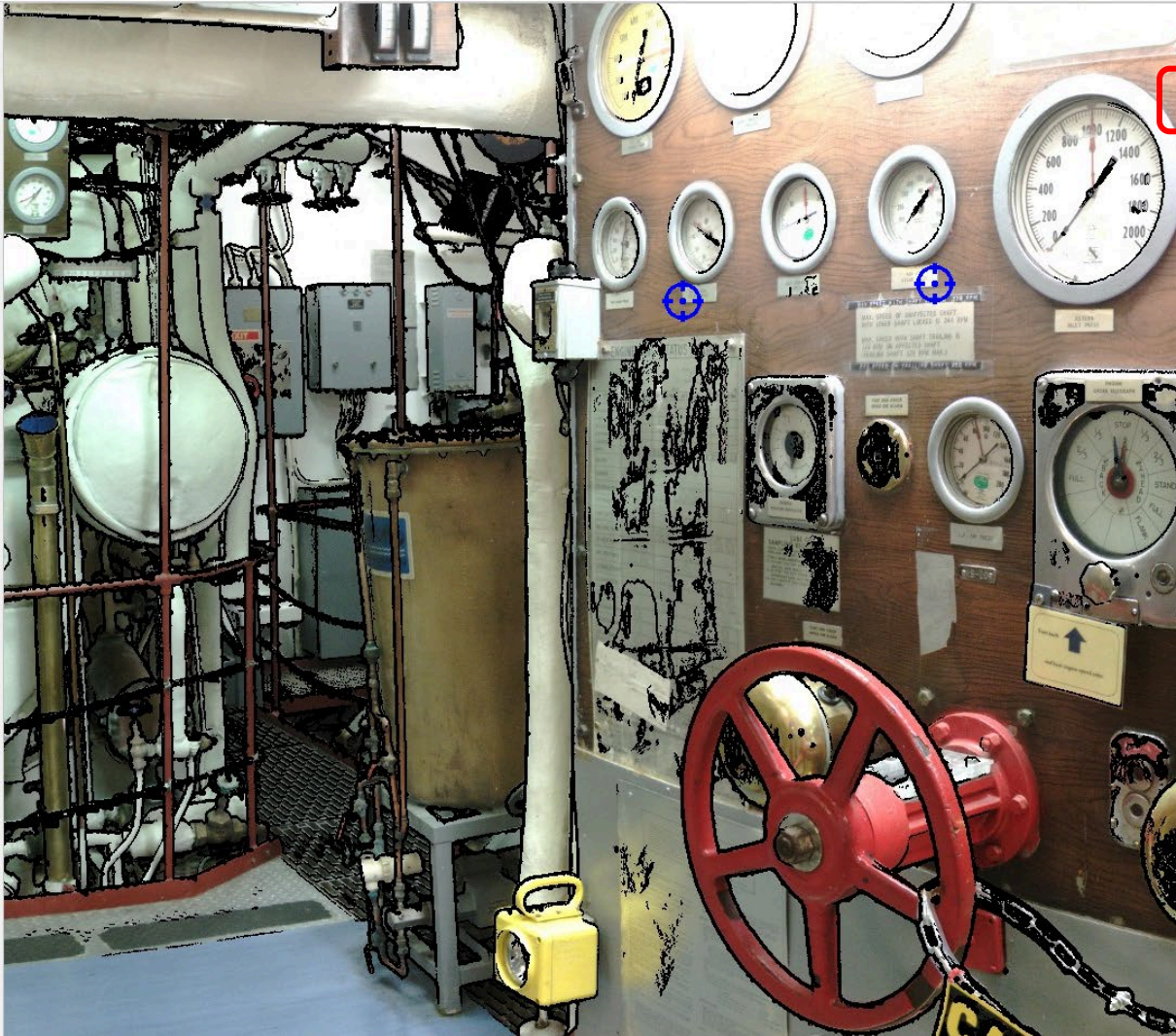


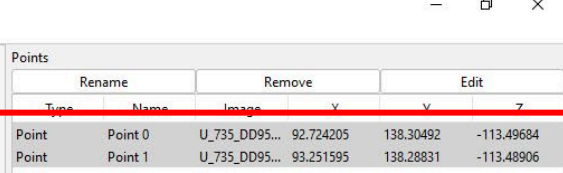
# Near Term Data Sharing Strategy: Pickle Jar

The Panorama Inspector and Calculation Kit for LiDAR Examination (Pickle) application is a NIWC PAC developed java based application that runs on NMCI and allows users to view, explore, and take measurements without any procurements, licenses, or software downloads.



**Scan Files**

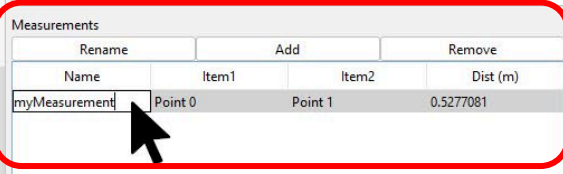




**User Generated Points**

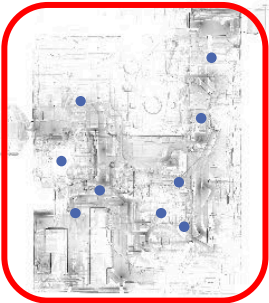
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Point	Point 1	U_735_DD95...	93.251595	138.28831	-113.48906


**Point to Point Measurements**



**Deck View with scan locations**

Measurements			
Rename	Add	Remove	
Name	Item1	Item2	Dist (m)
myMeasurement	Point 0	Point 1	0.5277081

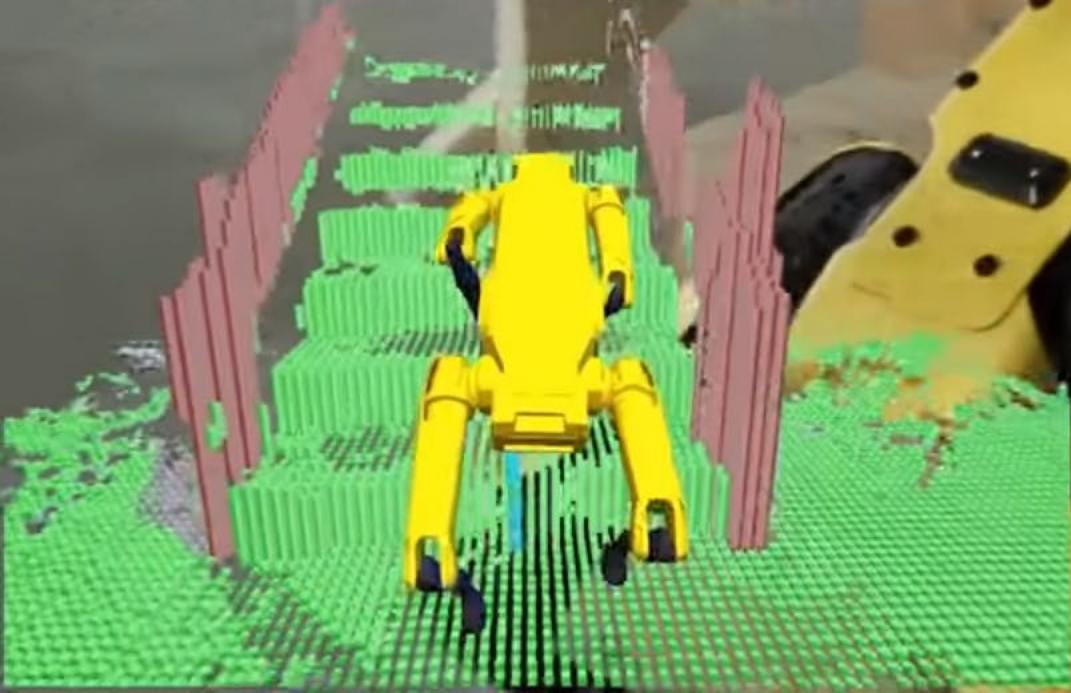






# Questions?

Obstacle Avoidance Data



Boston Dynamics