Coda Octopus

Sound Underwater Intelligence

UI2020 UNDERWATER INTERVENTION

Stand 220

GEO

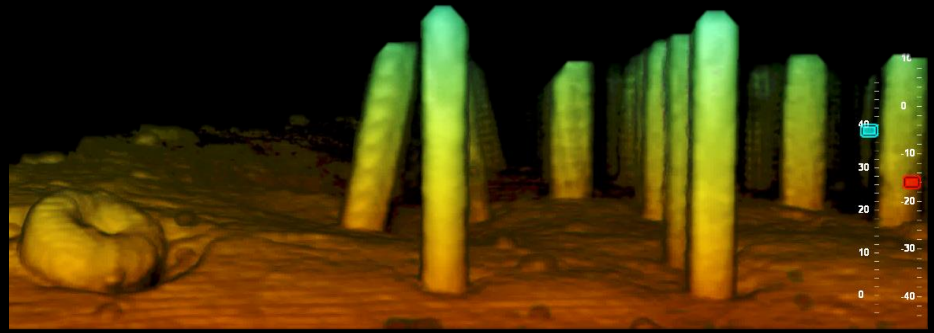
3D

MOTION

TEAM

TAP

Diver Augmented Vision Display System



Presented by

Blair Cunningham

President of Technology

GEO 3D MOTION TEAM TAP

Coda Octopus
Sound Underwater Intelligence

Coda Octopus Introduction

Global Footprint

Coda Octopus
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Echoscope4G® & 5G® family of Volumetric Sonars

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Real-Time 3D, 5D and 6D Visualization & Mapping for Widest Range of Applications

Echoscope4G®

Echoscope4G® C500

Compact Edition

Depth Rating

SWaP (Size, Weight and Power)

Echoscope4G® *Surface*

Echoscope4G® *Deep Water*

Echoscope4G® & 5G® family of Volumetric Sonars

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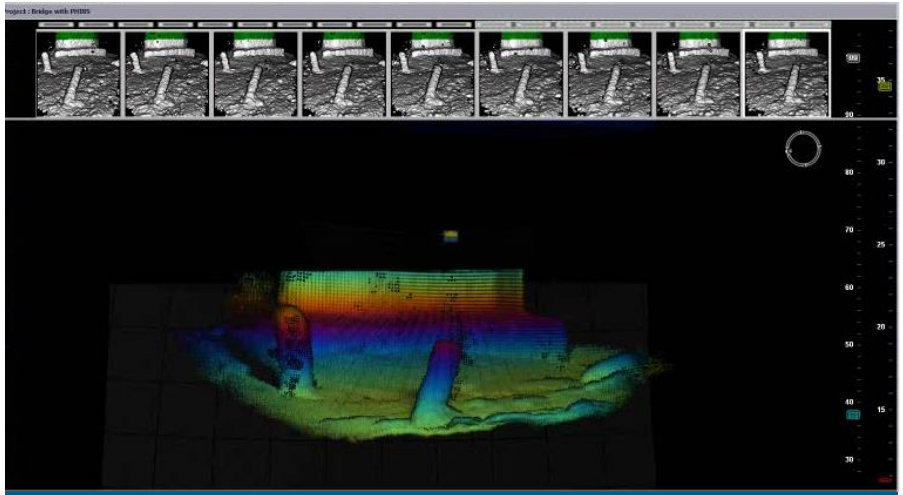
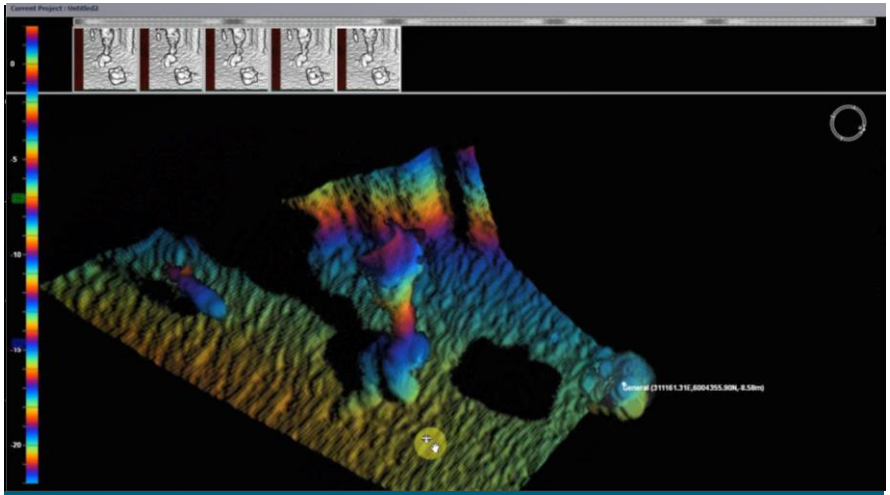
Single Sensor, Parallel Processing and Multi-Application for Real-Time Spatial Awareness, Vision, Mapping and Measurement



3D Complex Mapping – no post-processing



3D Camera Mode – unique

World's most diverse, functional and capable 3D sonar solution…

Project Background

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Project and Technology Outline

NAVSEA
WARFARE CENTERS
Panama City

- NSWC Panama City - Creators of underwater diving vision systems for over a decade!
- Many of their Monocular Display technologies exist in current commercial diving products today
- Started to research and investigate with transparent lens technology as the future of Diving vision technology



Non-Transparent Vision Display Systems

2016 Prototype System

Diver Augmented Vison Display System

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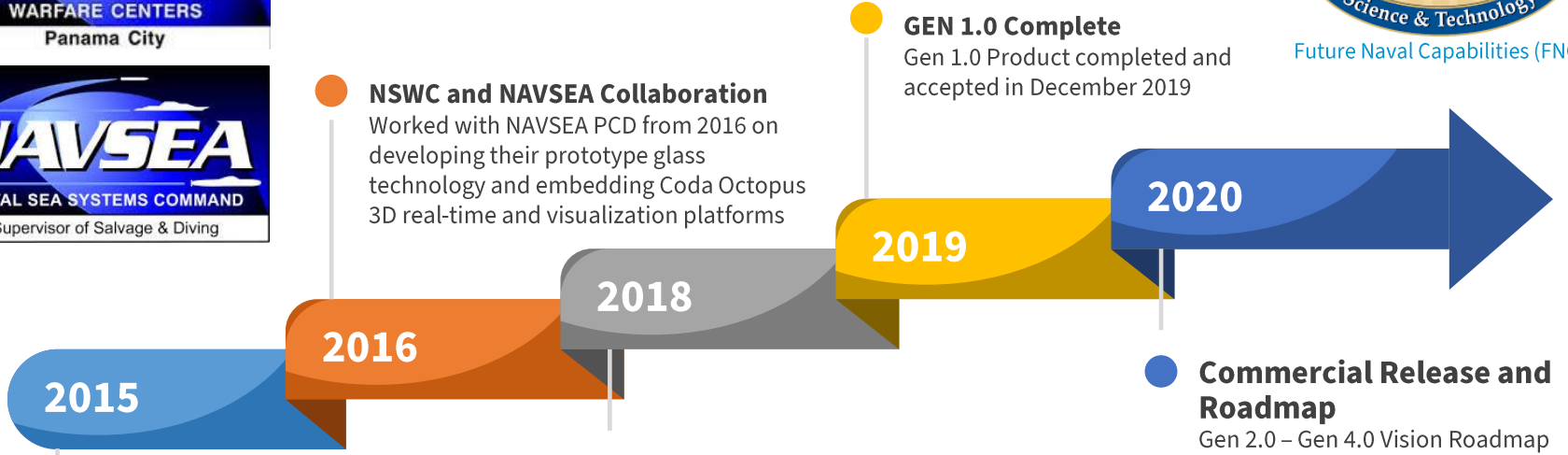
Project and Technology Outline

NAVSEA WARFARE CENTERS Panama City

NAVSEA NAVAL SEA SYSTEMS COMMAND Supervisor of Salvage & Diving

Office of Naval Research ONR Science & Technology

Future Naval Capabilities (FNC)



3D Diver Augmented Reality Concept
2015 Coda Octopus created the concept of 3D Augmented Reality technology for Divers to NAVSEA OOC

NSWC and NAVSEA Collaboration
Worked with NAVSEA PCD from 2016 on developing their prototype glass technology and embedding Coda Octopus 3D real-time and visualization platforms

Coda Octopus CRADA
Entered a CRADA agreement in 2018 with NSWC PCD and NAVSEA for the transfer of technology to final design and manufacturing

GEN 1.0 Complete
Gen 1.0 Product completed and accepted in December 2019

Commercial Release and Roadmap
Gen 2.0 – Gen 4.0 Vision Roadmap developed with NAVSEA and ONR under Future Naval Capabilities

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What is DAVD?

Diver Augmented Vison Display applications

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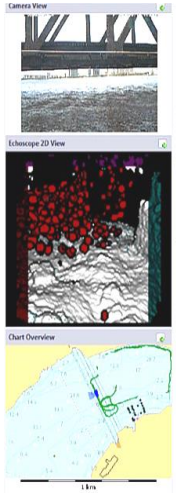

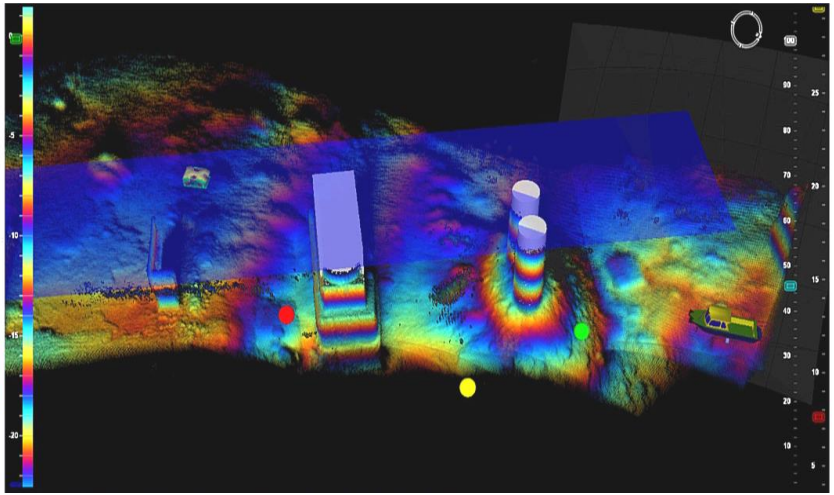

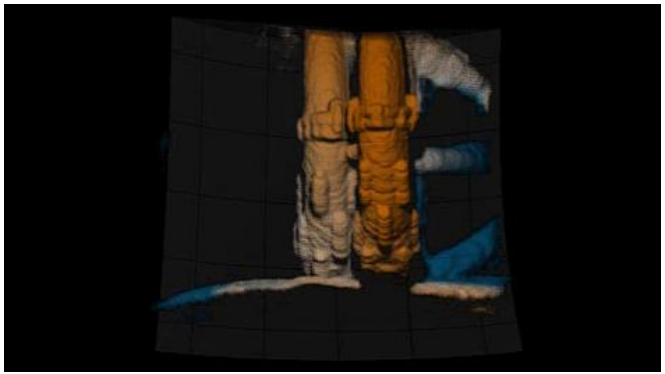

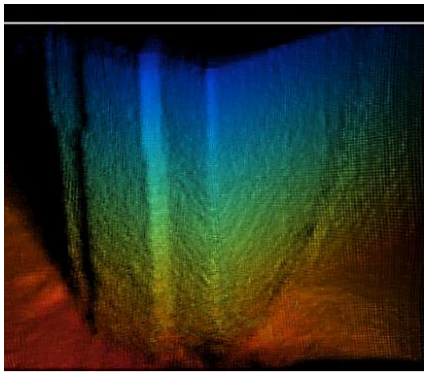

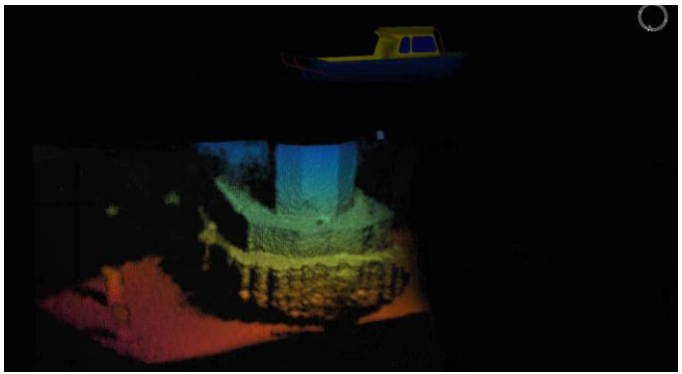

Diver Augmented Vison Display System

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LOCATION
Provide the Location of the Diver, the Diver Stage and Work Site and any hazards

VISIBILITY
Enhance the Diver experience with real-time Augmented and Mixed Reality scene awareness

COMMUNICATION
Communicate with rapid TEXT messaging for instruction, guidance and acknowledgement

SAFETY
Diver and Supervisor visually synchronized and can coordinate movement, tasks and health status

DATA
Diver and Supervisor can share and access all project technical and visual data in real-time

Diver Augmented Vison Display System

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1

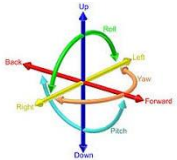
DAVD - TC

Dive Supervisor Workstation and Communication Hub

2

DAVD - DPP

The Diver Processing Unit fuses sensor data and manages ultra low latency video display



3

DAVD - DMU

Dive Motion Unit handles Head Tracking and Motion

4

DAVD - HUD

Transparent Lens Based Head Up Display

Diver **A**ugmented **V**ison **D**isplay applications

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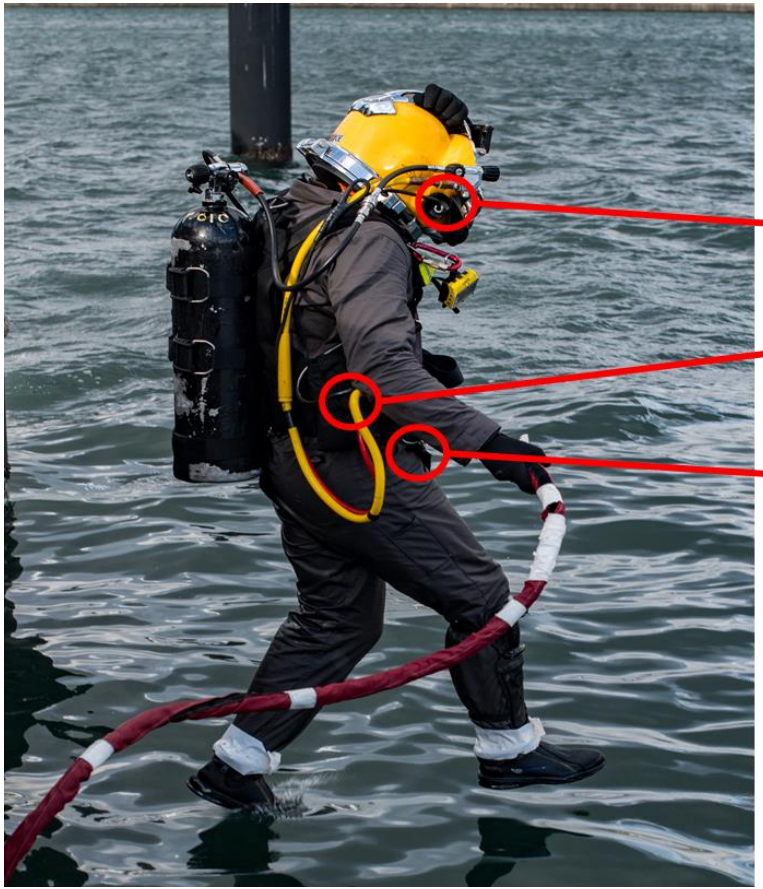

Comms Penetrator – ***Custom Kirby Morgan*** Part with Fischer Connector

DPP – Proposed Mounting Location

DPP – Umbilical Main Line Connection

Diver Augmented Vison Display System

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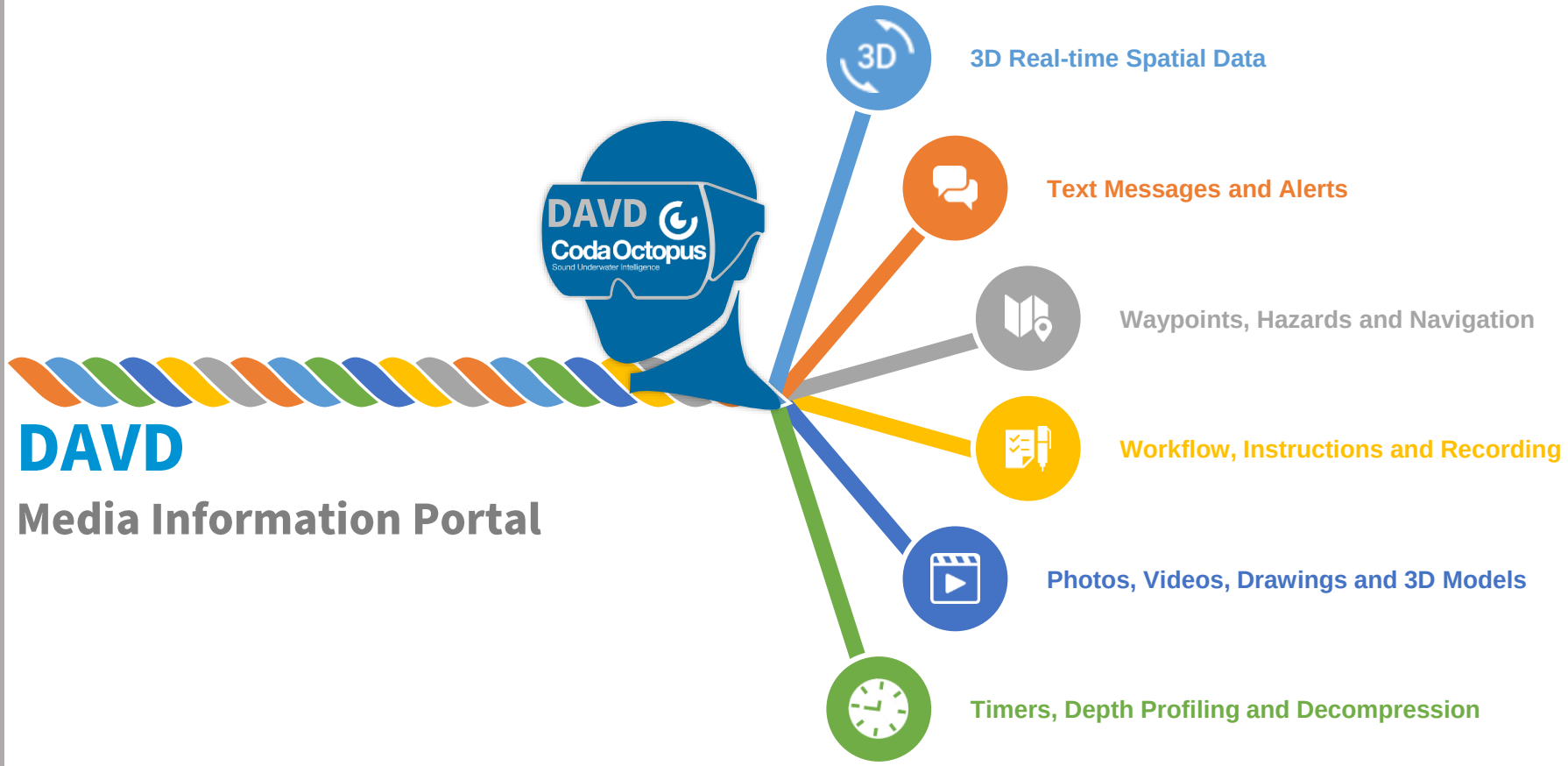
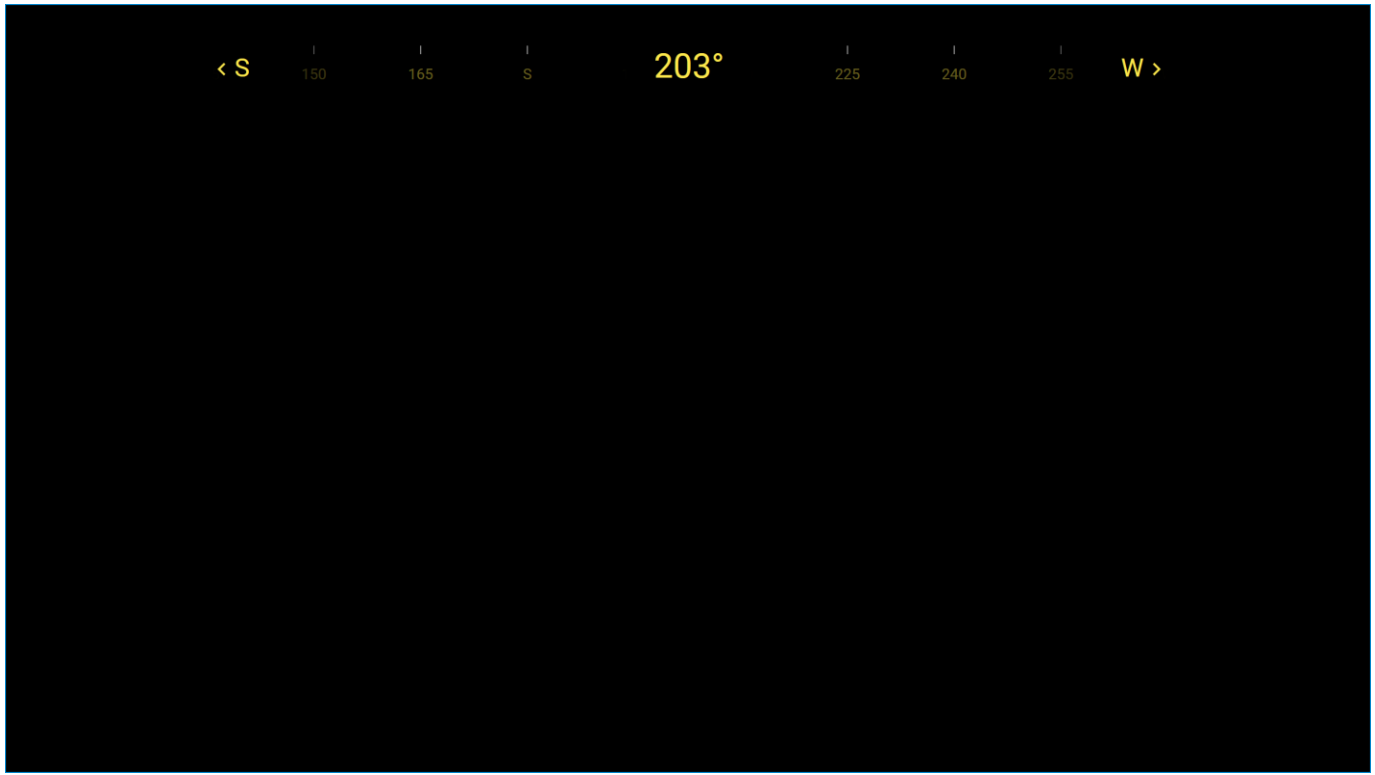


Diver **A**ugmented **V**ison **D**isplay System



DAVD

Diver HUD View

Heading, Pitch & Roll

Diver **A**ugmented **V**ison **D**isplay System

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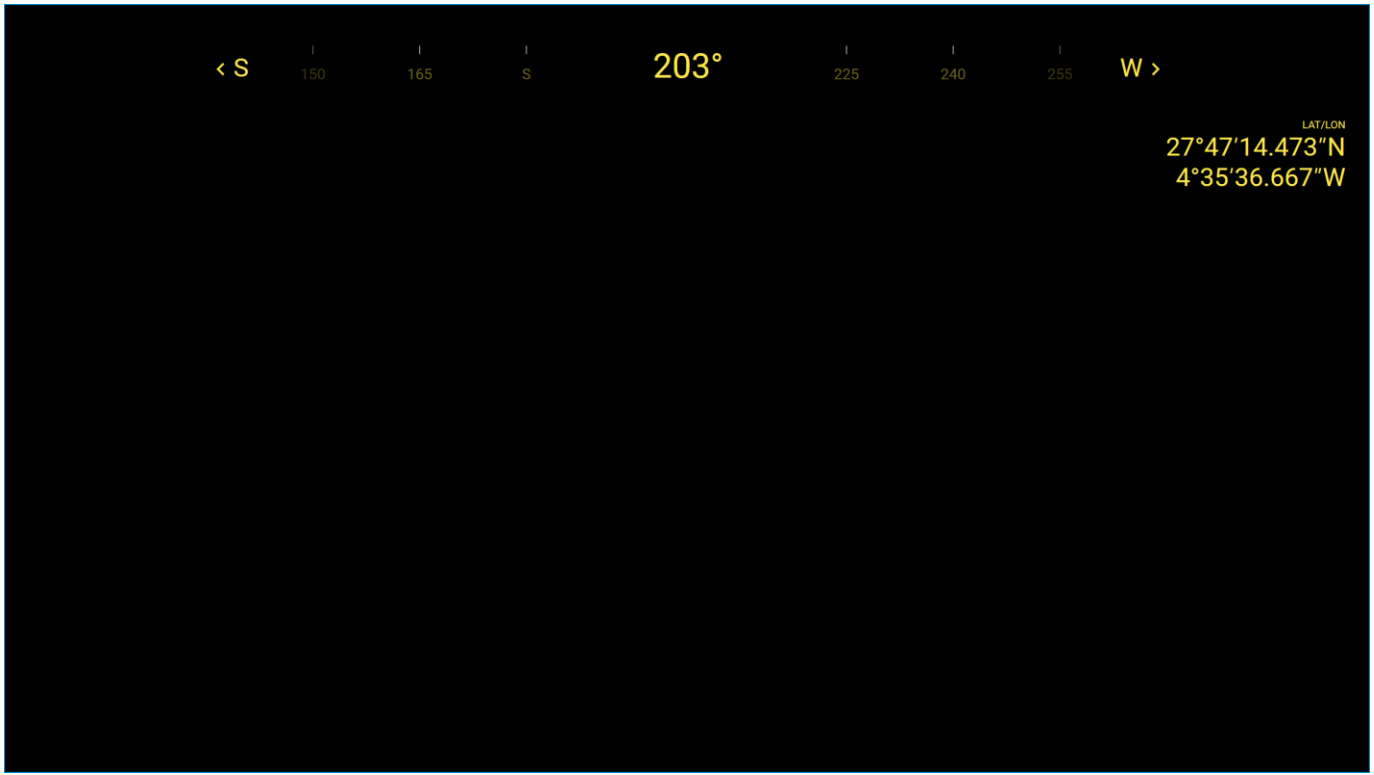

DAVD

Diver HUD View

Heading, Pitch & Roll
Position (LAT/LONG)

Diver **A**ugmented **V**ison **D**isplay System

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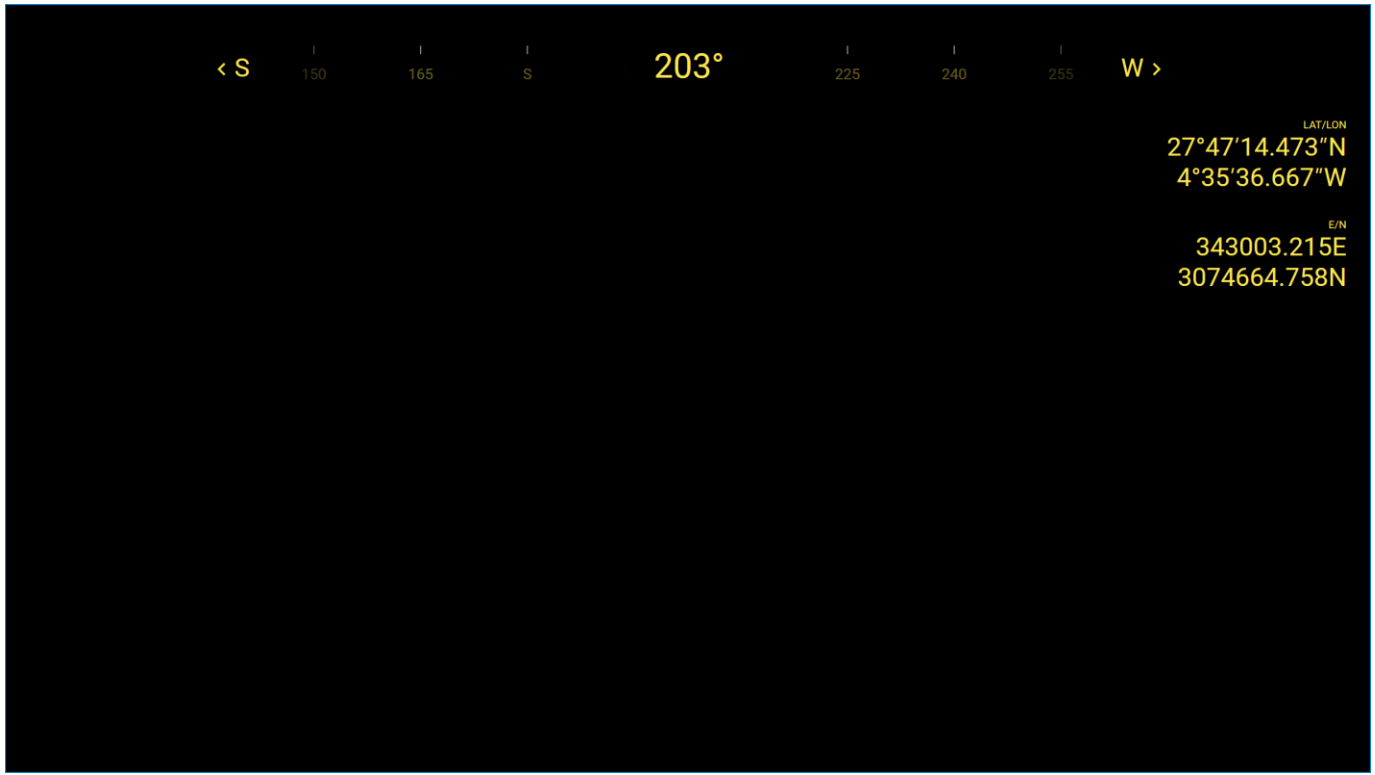

DAVD

Diver HUD View

Heading, Pitch & Roll
Position (LAT/LONG)
Position (E/N)

Diver **A**ugmented **V**ison **D**isplay System

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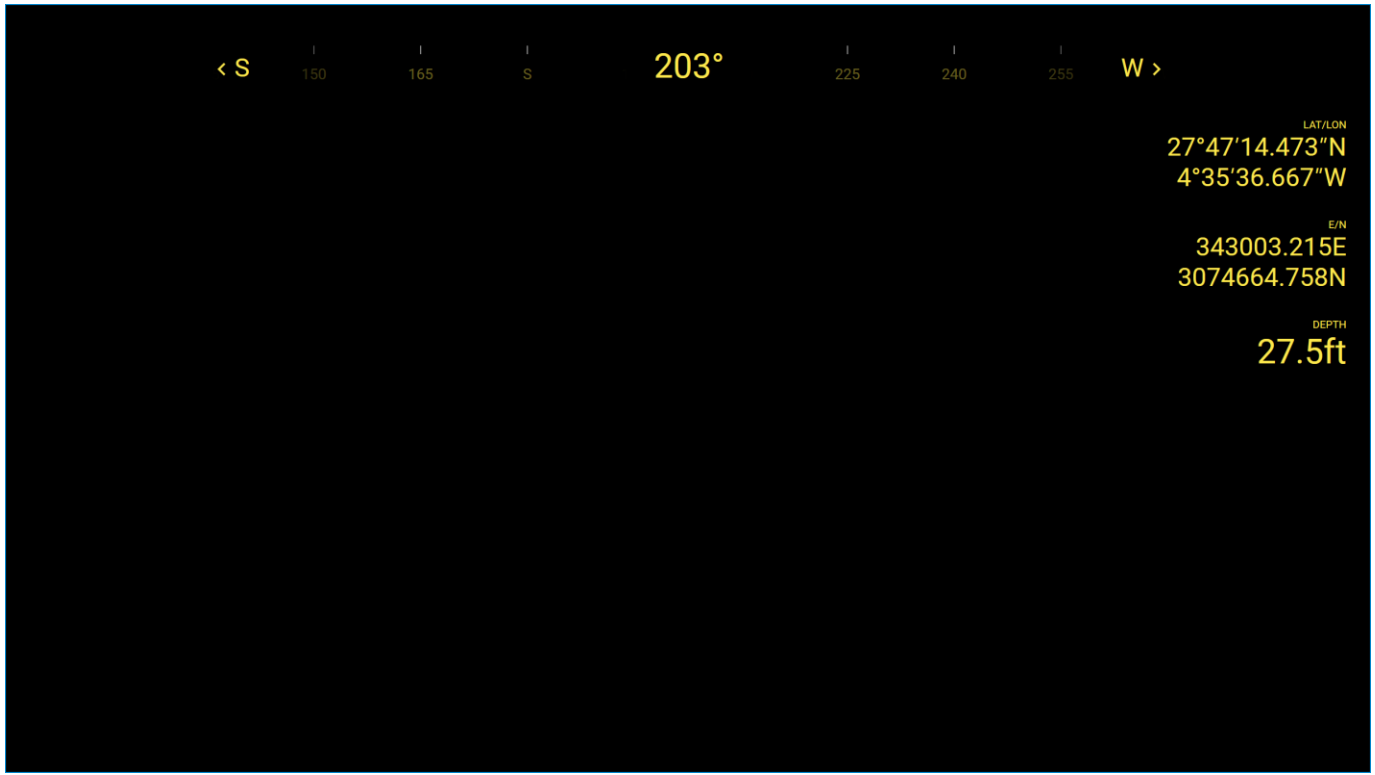

DAVD

Diver HUD View

Heading, Pitch & Roll
Position (LAT/LONG)
Position (E/N)
Diver Depth

Diver **A**ugmented **V**ison **D**isplay System

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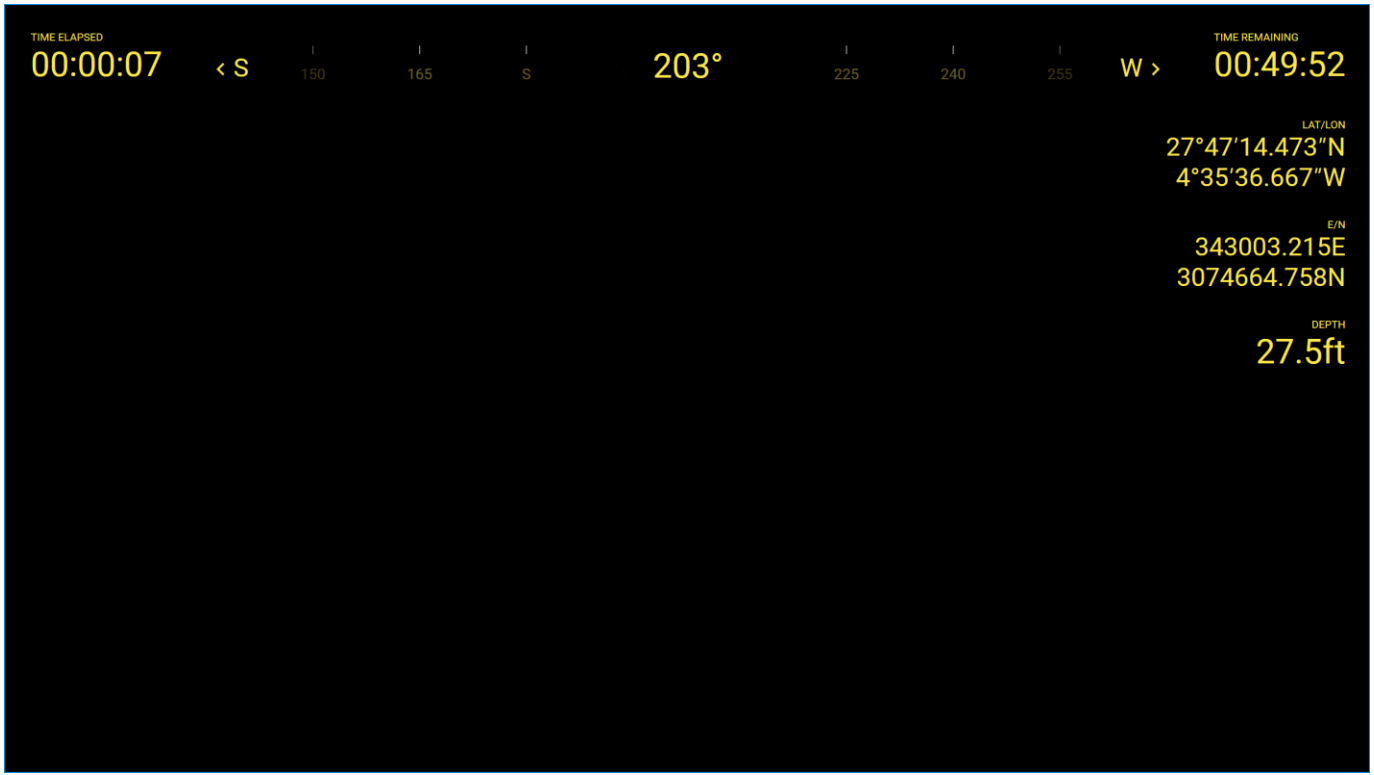

DAVD

Diver HUD View

Heading, Pitch & Roll
Position (LAT/LONG)
Position (E/N)
Diver Depth
Dive Time Elapsed and Remaining

Diver **A**ugmented **V**ison **D**isplay System

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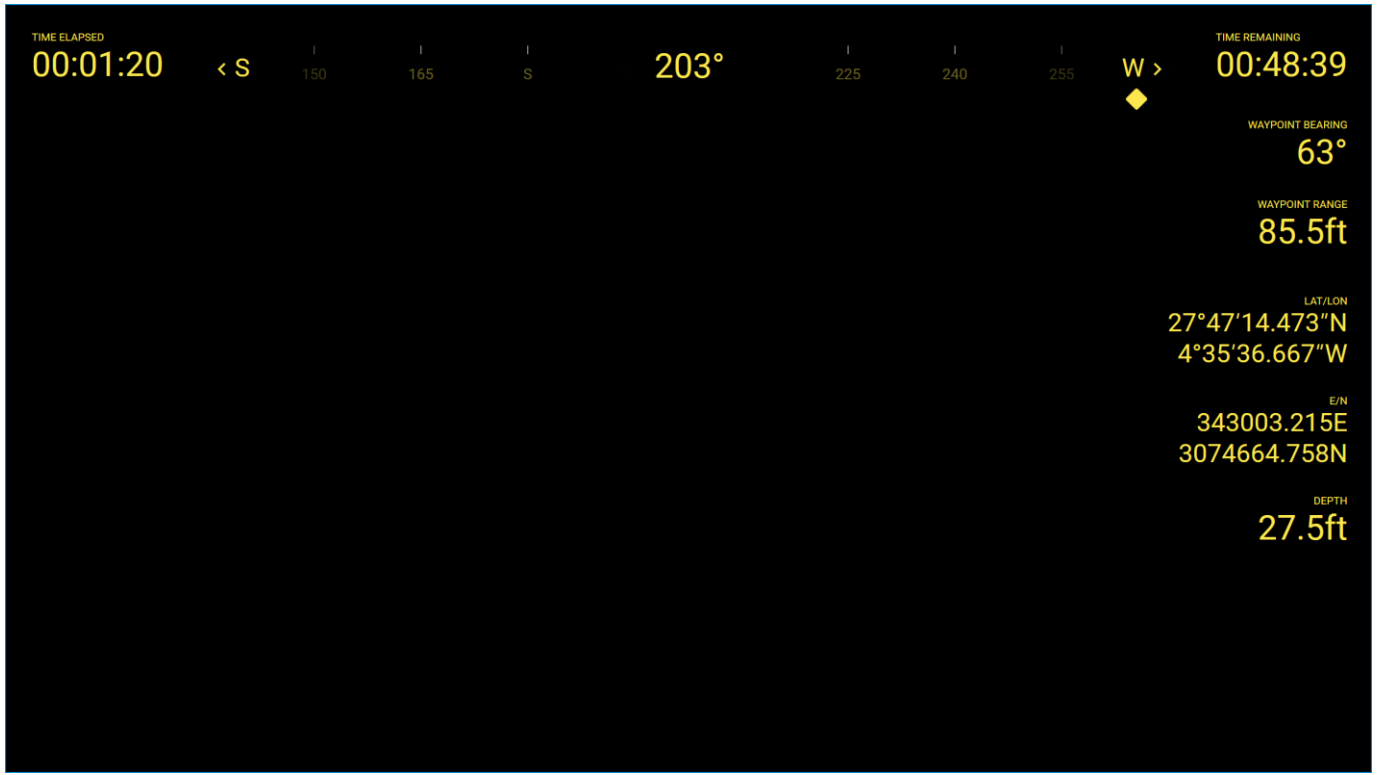

DAVD

Diver HUD View

Heading, Pitch & Roll
Position (LAT/LONG)
Position (E/N)
Diver Depth
Dive Time Elapsed and Remaining
Waypoint Range and Bearing

Diver Augmented Vison Display System

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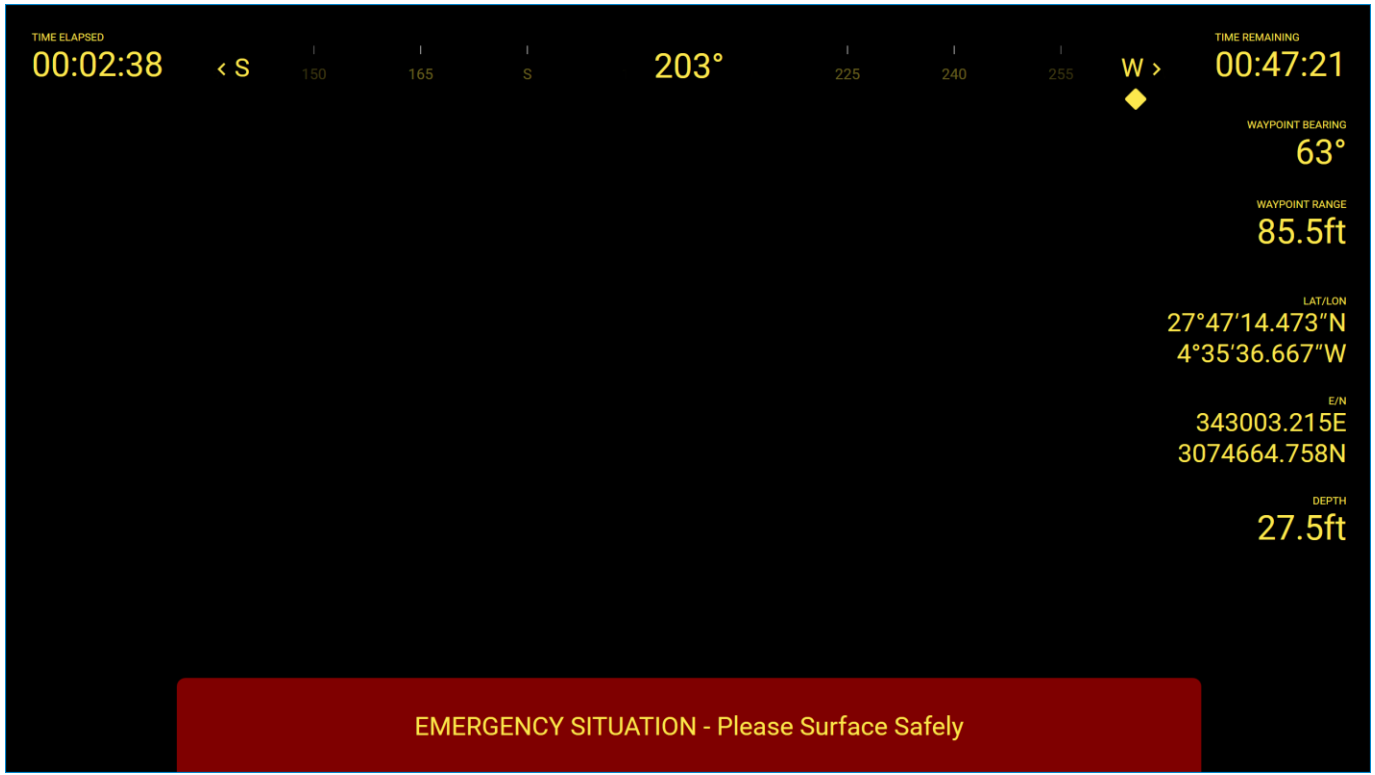

DAVD

Diver HUD View

Heading, Pitch & Roll
Position (LAT/LONG)
Position (E/N)
Diver Depth
Dive Time Elapsed and Remaining
Waypoint Range and Bearing
Live Messaging

Diver **A**ugmented **V**ison **D**isplay System

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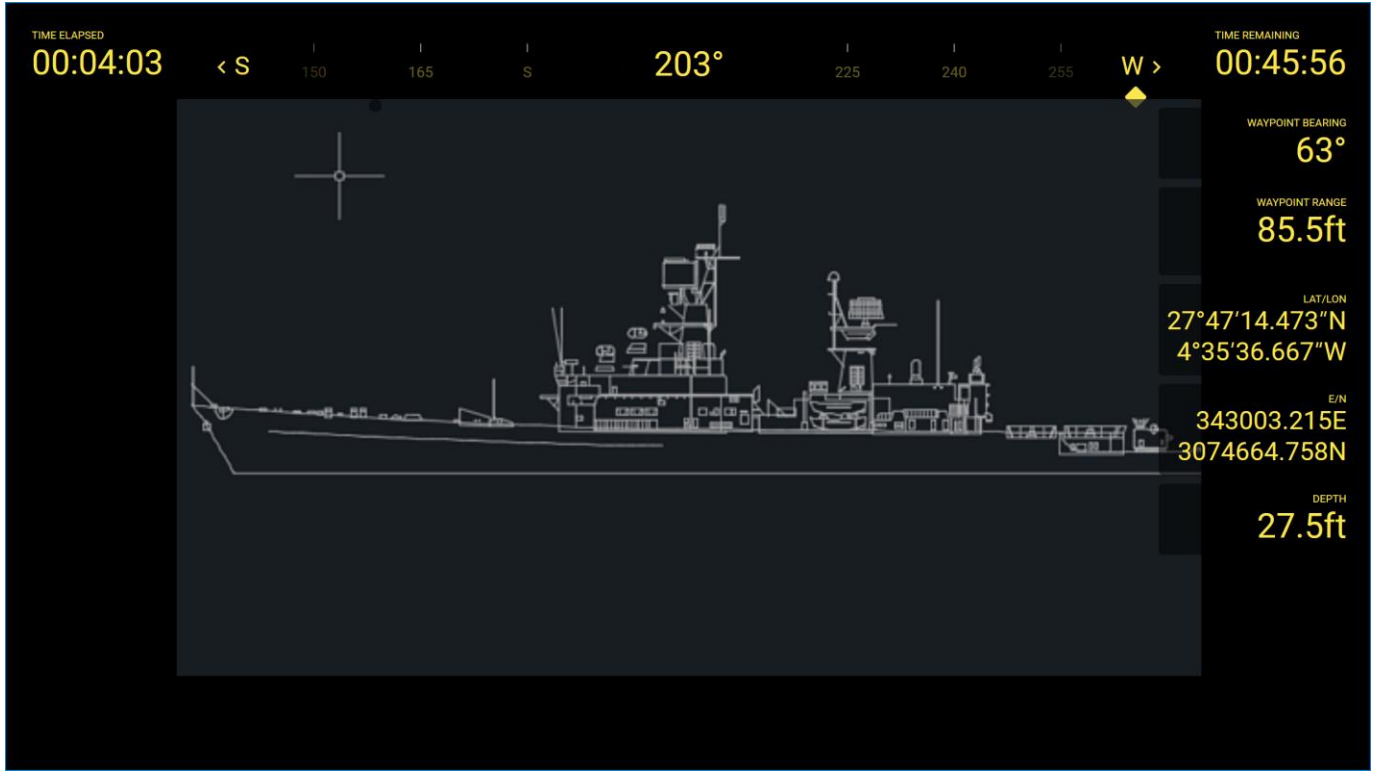
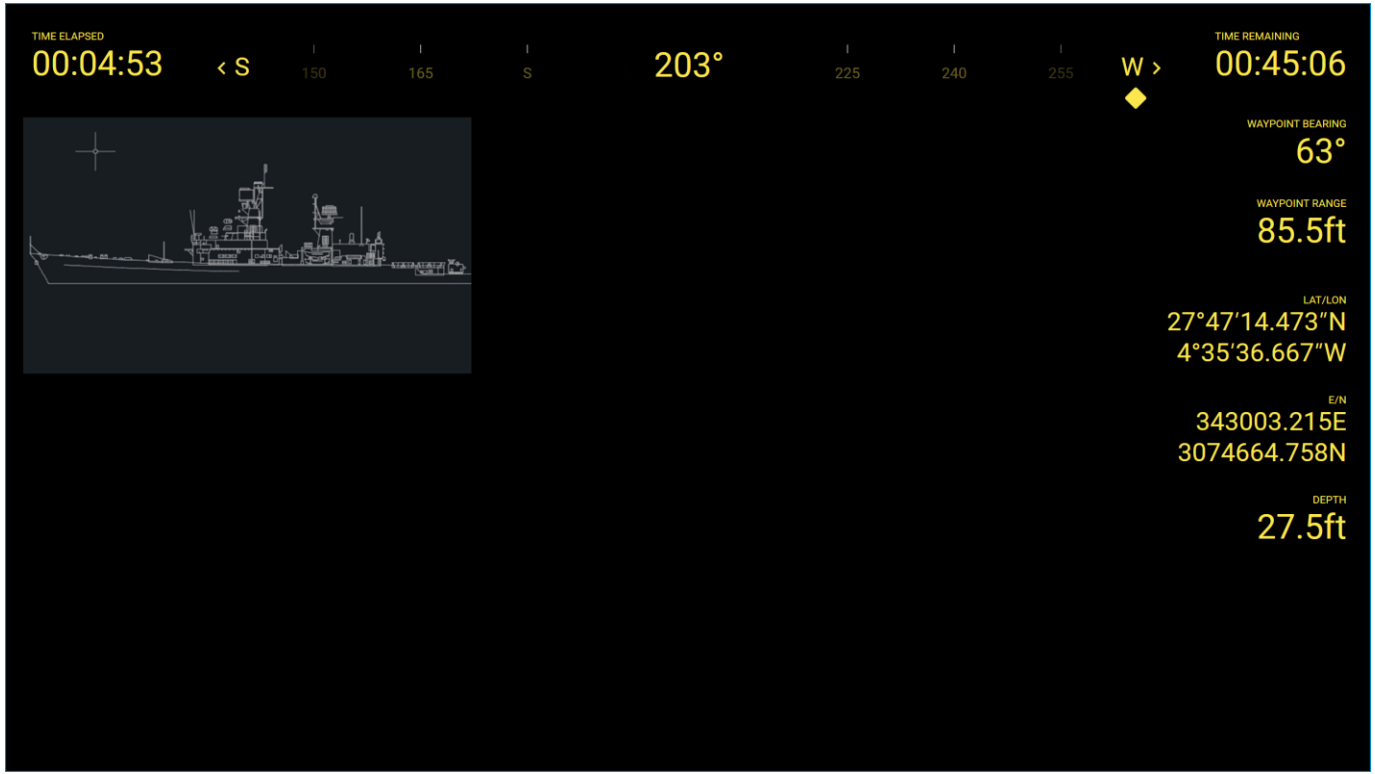


DAVD

Diver HUD View

Heading, Pitch & Roll
Position (LAT/LONG)
Position (E/N)
Diver Depth
Dive Time Elapsed and Remaining
Waypoint Range and Bearing
Live Messaging
Images, Drawings, Technical Data and Workflow - Full

Diver Augmented Vison Display System



DAVD

Diver HUD View

Heading, Pitch & Roll
Position (LAT/LONG)
Position (E/N)
Diver Depth
Dive Time Elapsed and Remaining
Waypoint Range and Bearing
Live Messaging
Images, Drawings, Technical Data and Workflow - Minimized

Diver Augmented Vison Display System

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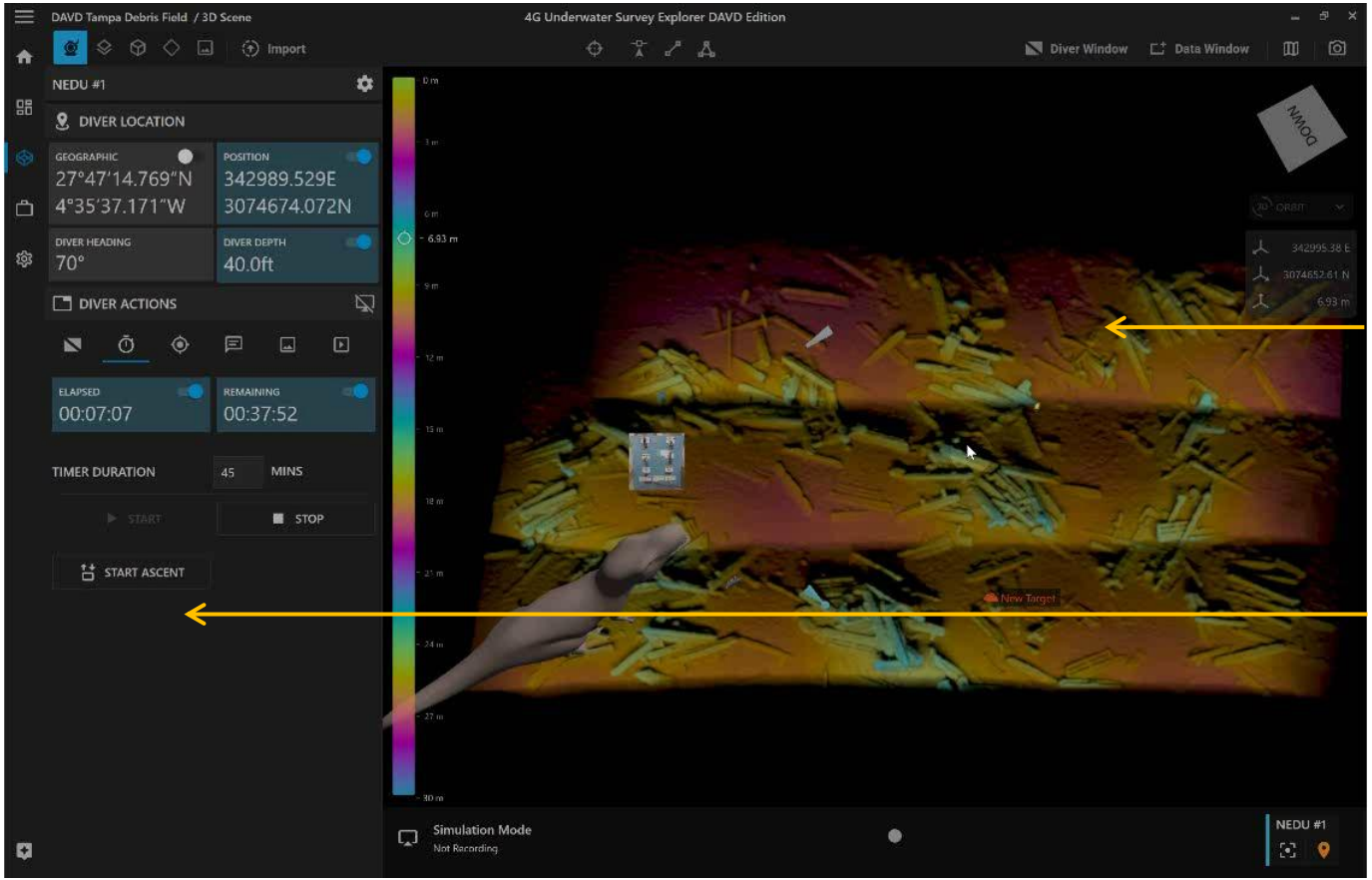

DAVD

Dive Supervisor Console Software

3D Scene with Full Indepdent control

3D Model and Target Support

Easy to Use Diver Control Panel

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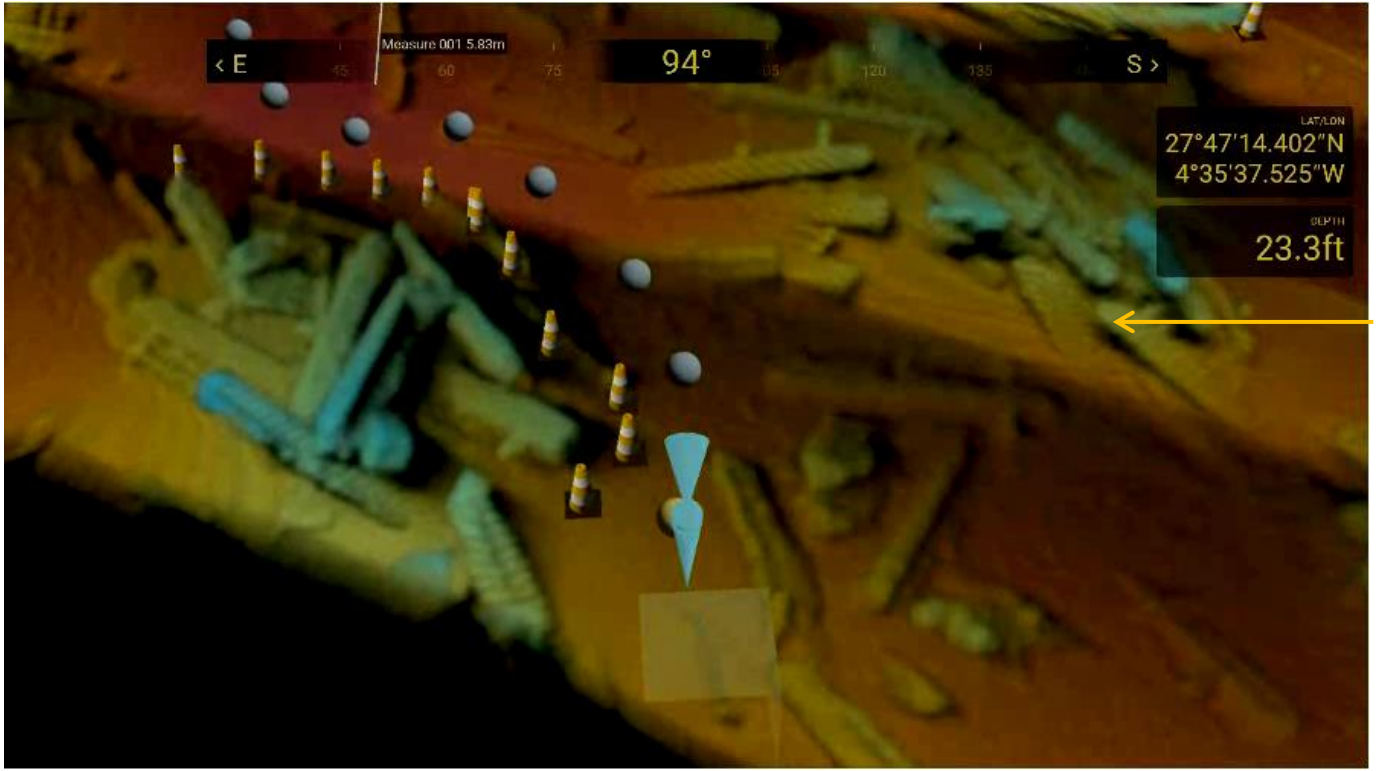

DAVD

Diver "Follow" View Mode

Real-Time Heading Data

Live Position and Depth Data

Detailed 3D Map Augmented with Path Planning and Hazards

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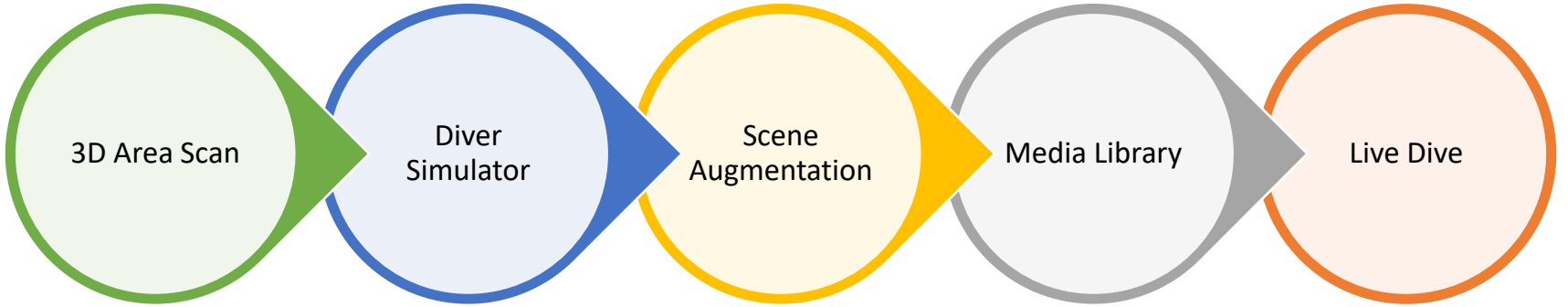
Dive Project Workflow



3D Area Scan	Diver Simulator	Scene Augmentation	Media Library	Live Dive
Three options for 3D Area Data Collection – Detailed Survey, Fixed Scan and Rapid Response	Diver Simulator allows Diver and Supervisor to pre-plan routes and divers to feel comfortable with data and environment	3D scene can be augmented with 3D Models of known structure, targets and Geo hazards can be added with live measures	The project can be preloaded with Mission Instructions, Drawings Images and video to support the diver	Full LIVE control of Diver visual environment and ability to send on-demand data, technical information and messaging

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DAVD Operational Use Scenarios

Vessel / AUV or ROV
Survey in advance of dive operations

- Highest Resolution 3D scan with minimal shadows and optimum target illumination
- Completely Georeferenced dataset allowing instant augmentation with other spatial data (Sat Imagery, Charts)
- Cover larger survey areas such as construction site or salvage operations

Static Rotational Scan
Scan from a fixed location

- Simple setup on barge, quay wall, tripod or fixed structure.
- Create full circular 3D scan in under 10 seconds
- Data collected from a singe viewpoint so some targets will remain in shadow
- 3D Scan configuration can be used to show Live Diver tracking and map updates

Diver Hand Held
Live Scan of area in real-time

- Simple setup with Diver benefiting from real-time Forward looking 3D Data – 1st Person Perspective
- Challenging to create real-time maps as diver is moving unless accurate diver positioning is available
- Diver can swim with sonar to work location and then stand system nearby for live monitoring

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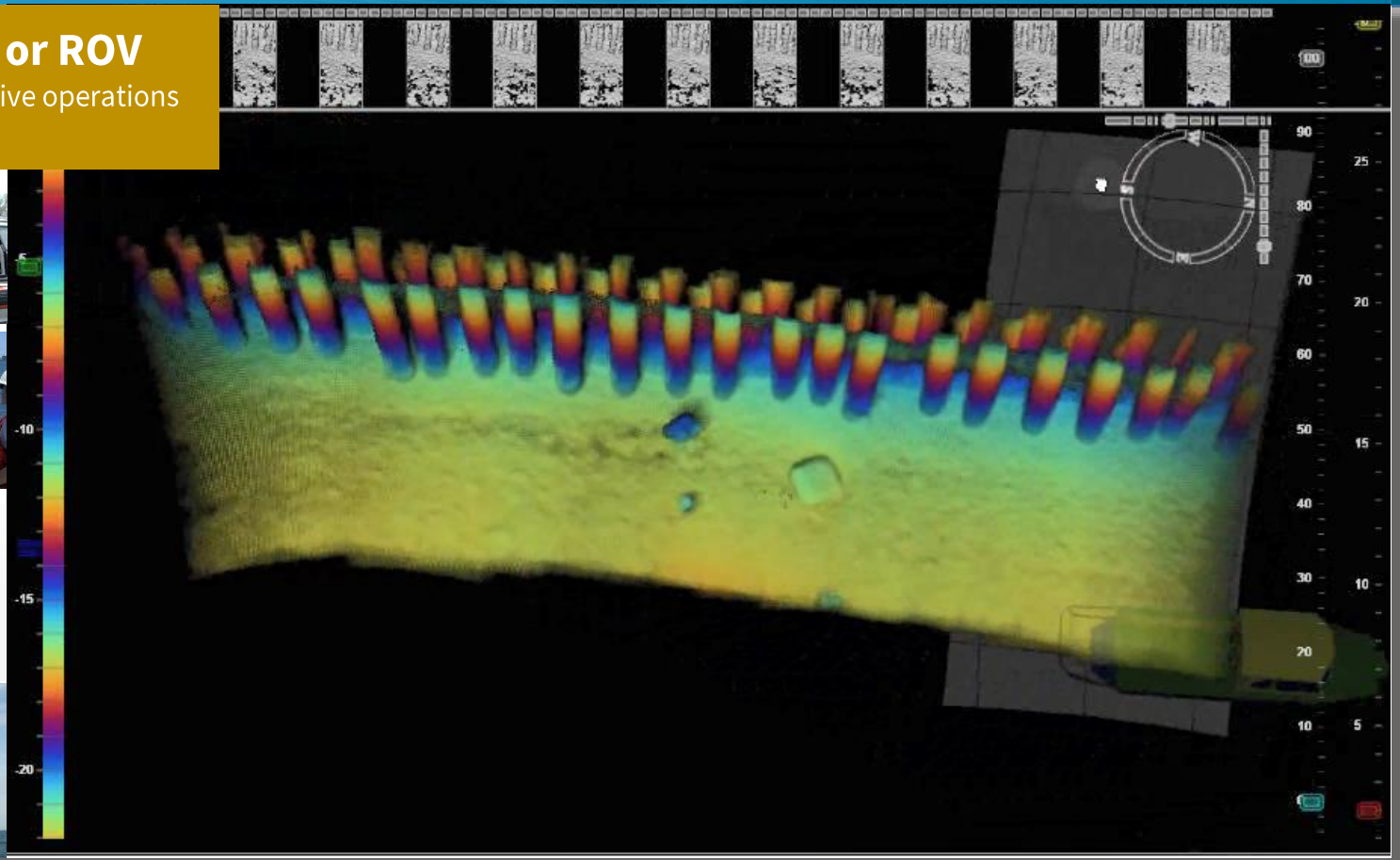
Vessel / AUV or ROV

Survey in advance of dive operations



Diver Augmented Vison Display System

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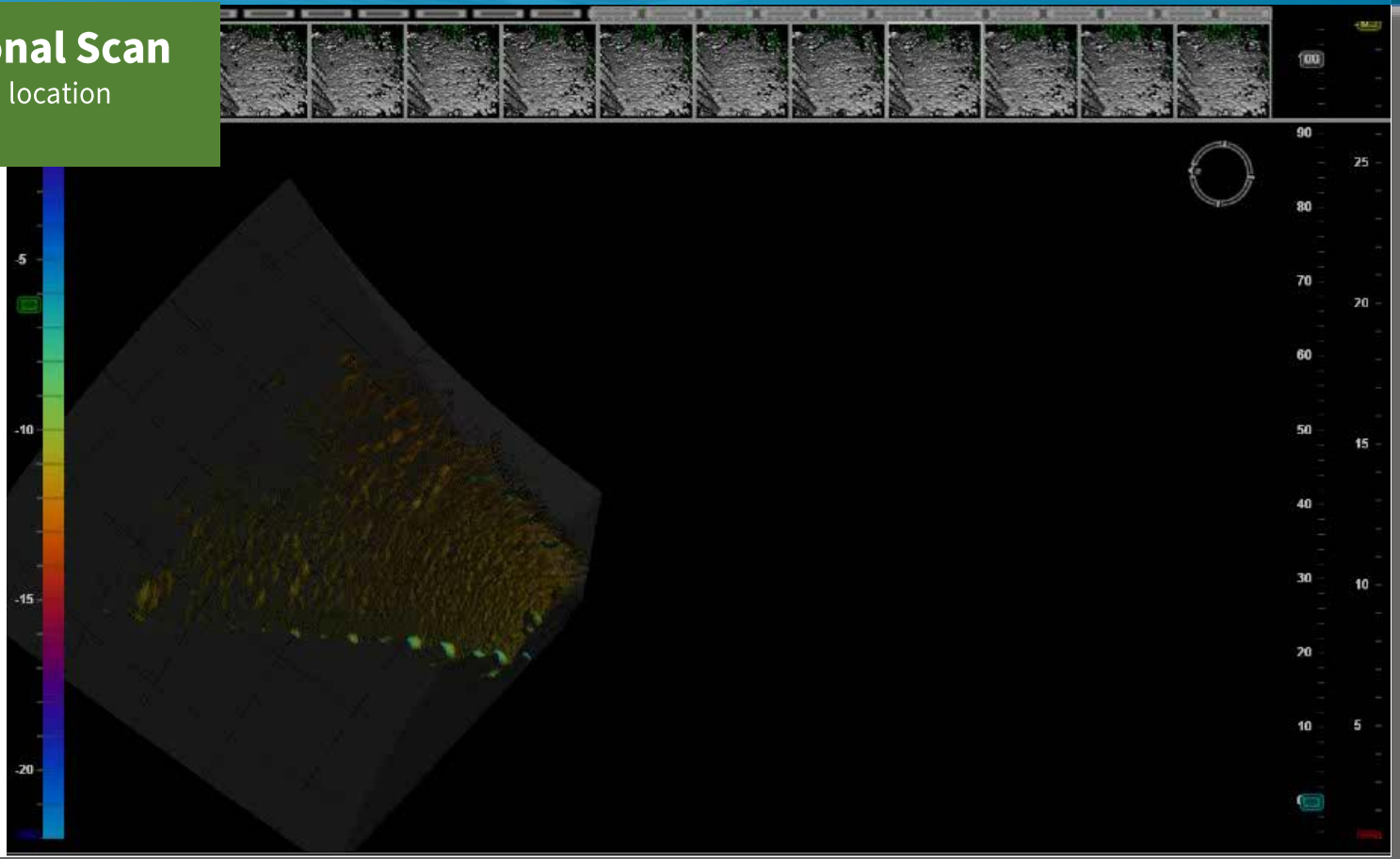
Static Rotational Scan

Scan from a fixed location



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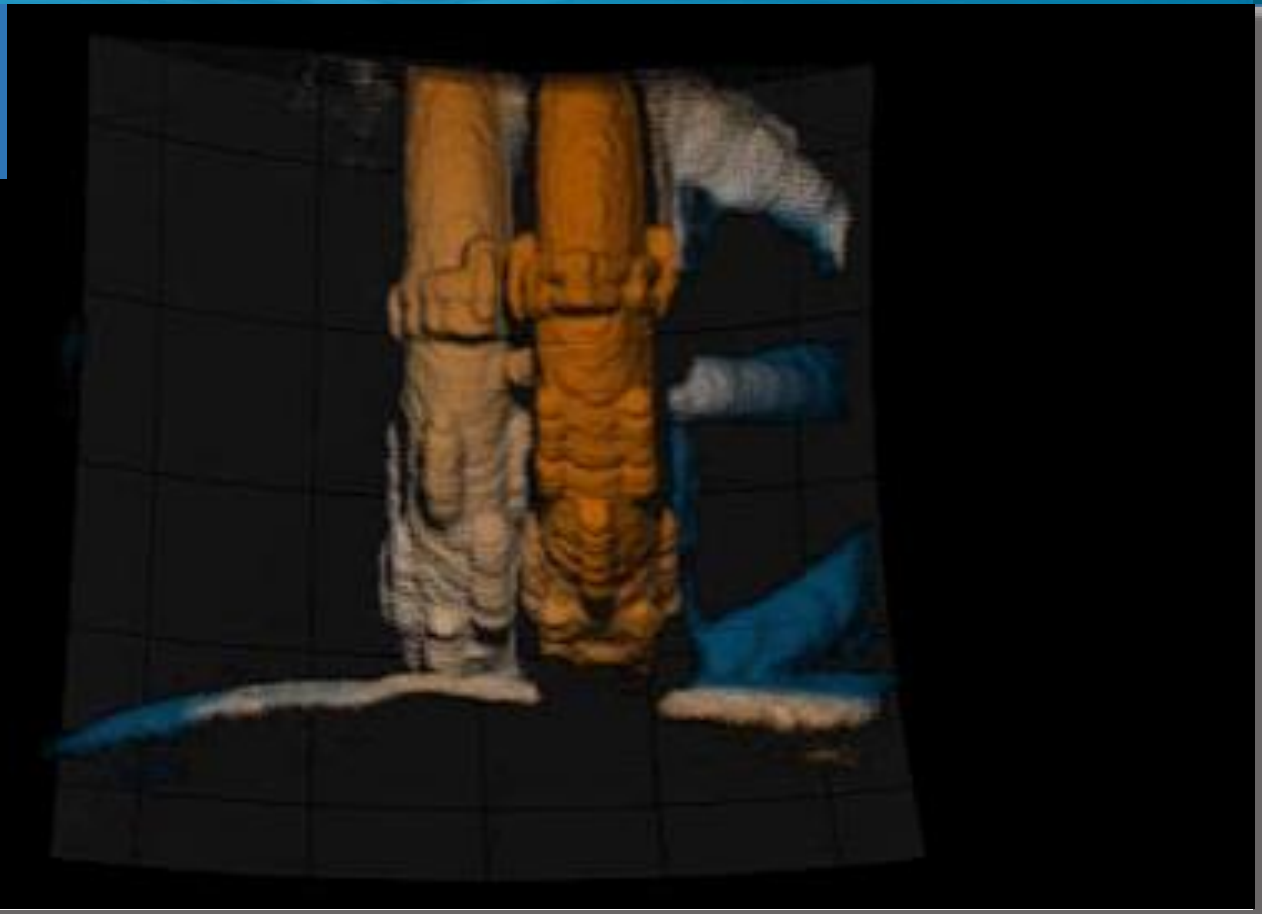
Diver Hand Held

Live Scan of area in real-time



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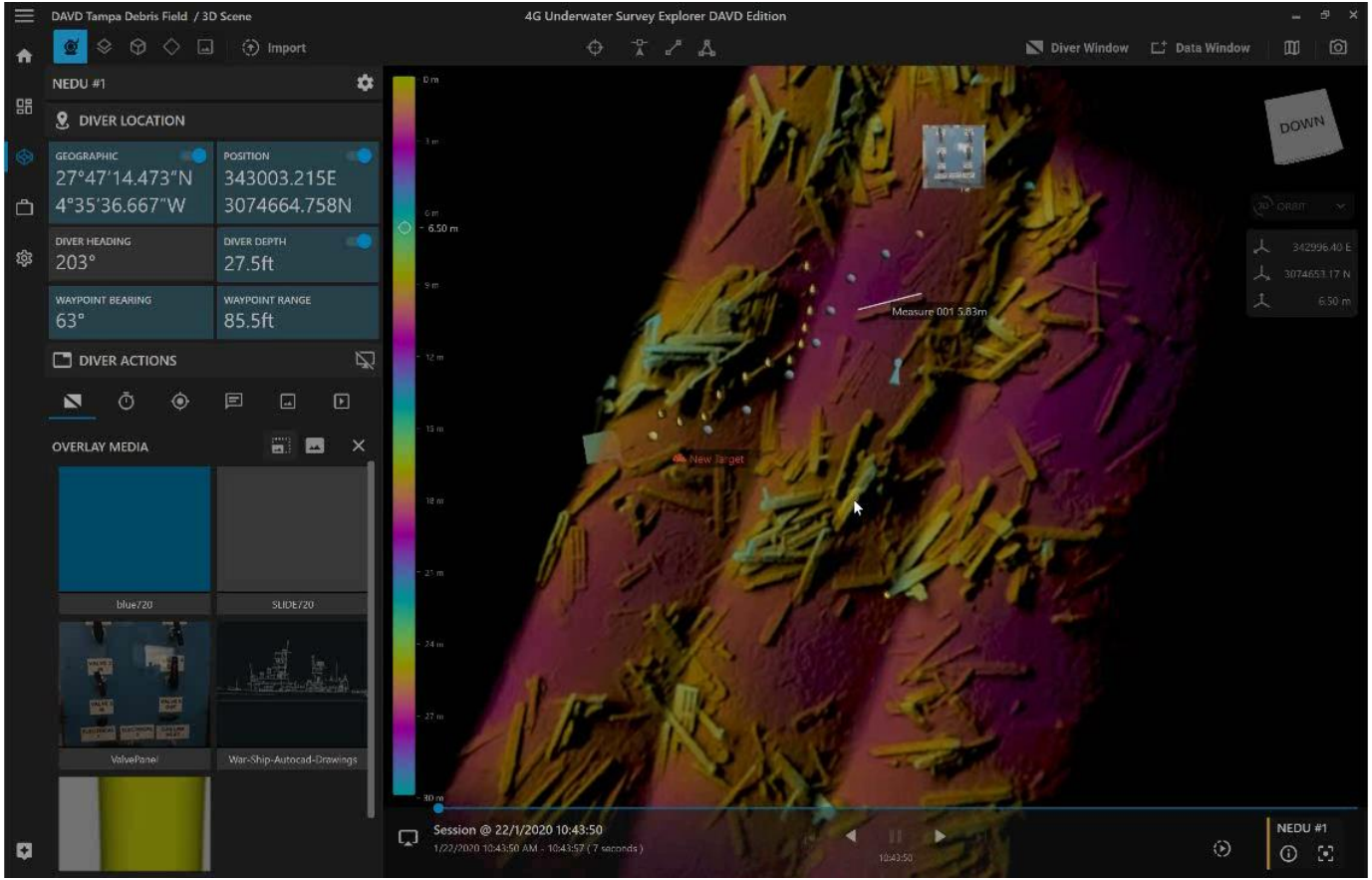

DAVD

3D Scene Augmentation

- 3D Primitive Shapes
- 3D User Models
- Geo-Referenced Image (Satellite)
- CAD/Design
- Measurements
- GEO Hazards
- Routes
- Waypoints

more....

Diver Augmented Vison Display System

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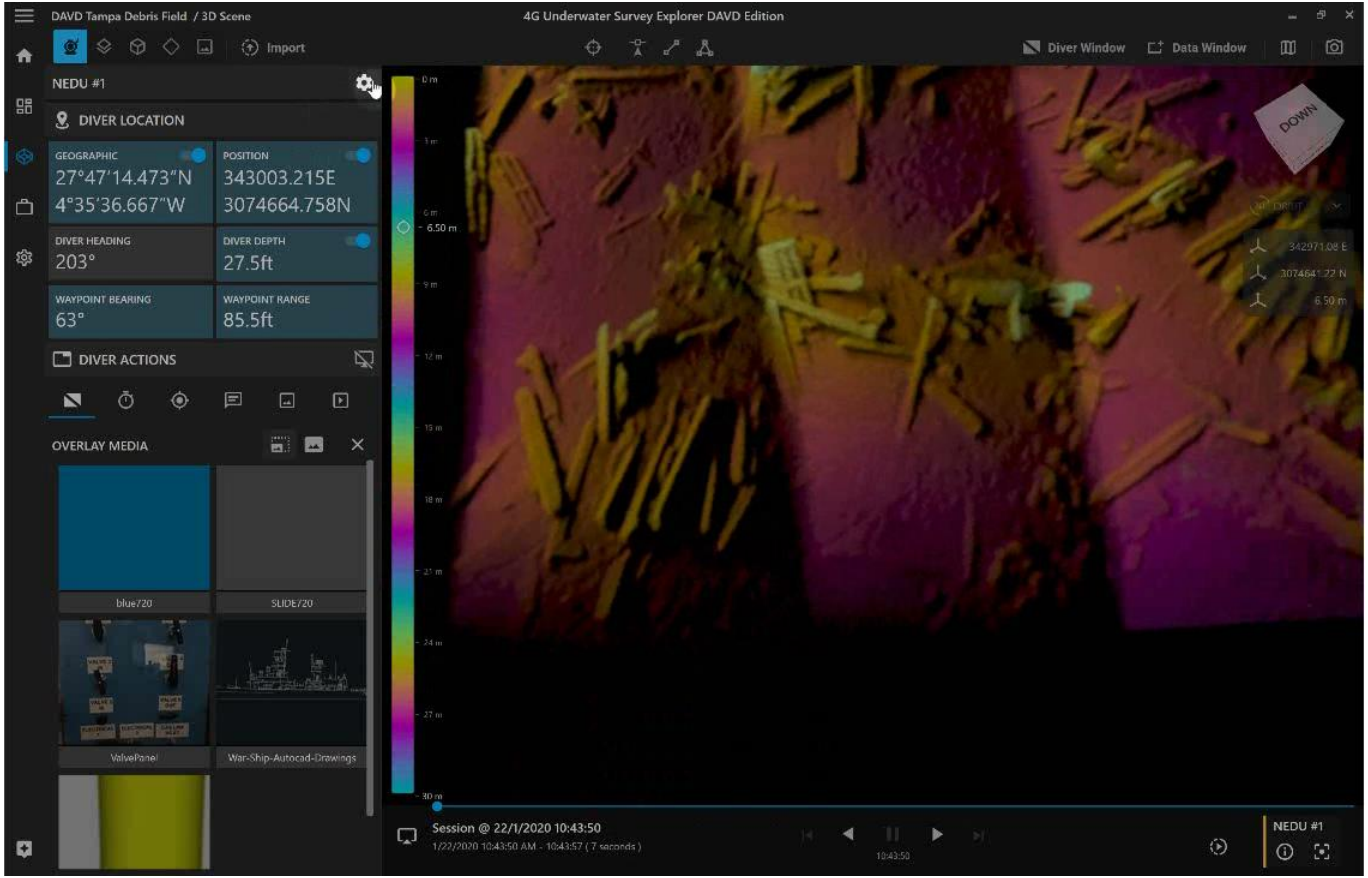


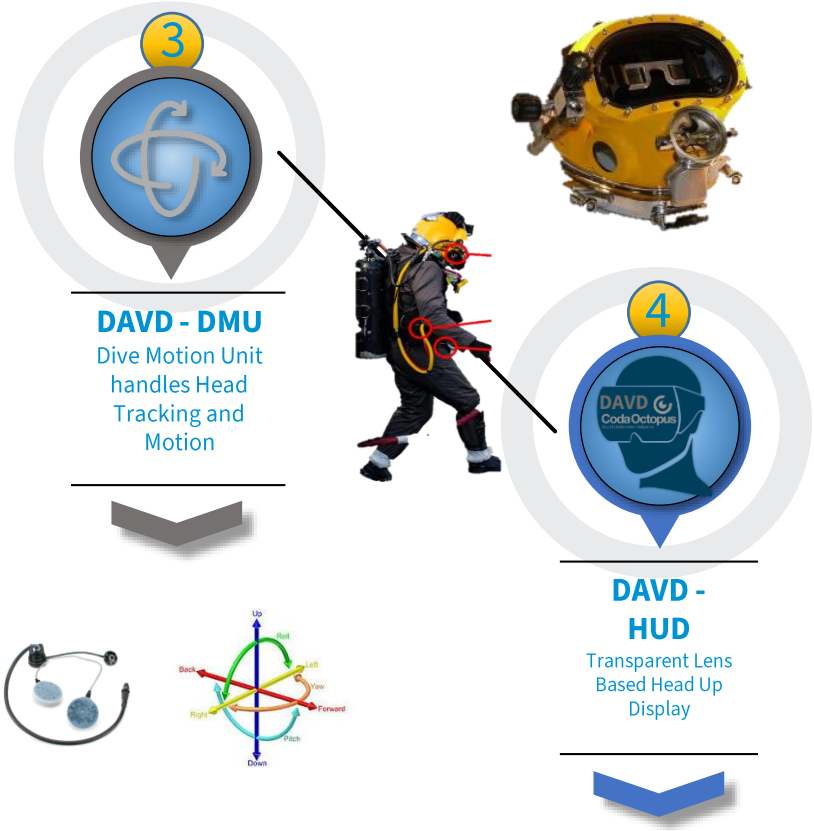
DAVD

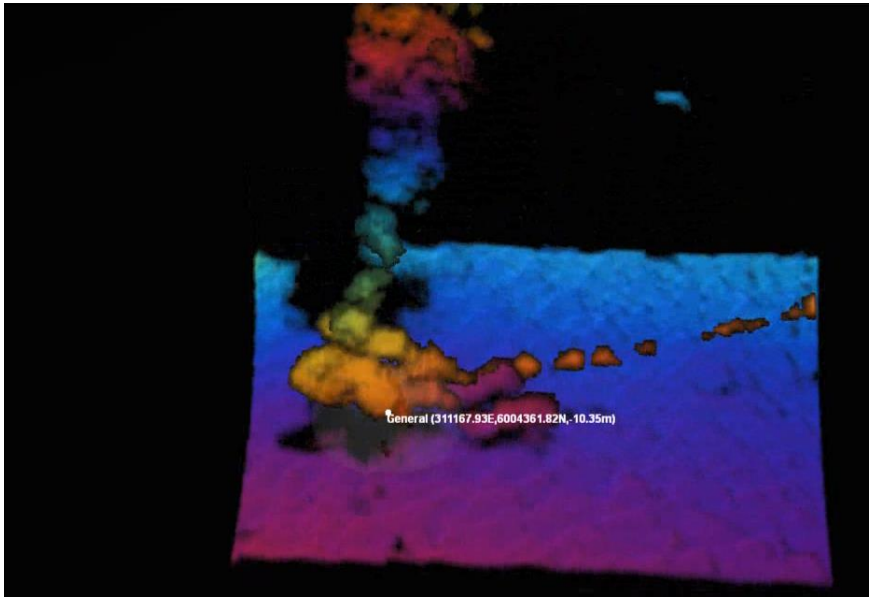
Media Library and Workflow

- 2D Images
- Geo-referenced Images
- Task Instruction
- Slide Decks with step-by-step guide
- Billboard Images

more....

Diver Augmented Vison Display System





3D MATT (Multiple Automated Target Tracking provides most accurate real-time diver positioning using Echoscope C500 real-time Imaging Sonar.

Optional USBL positional input.

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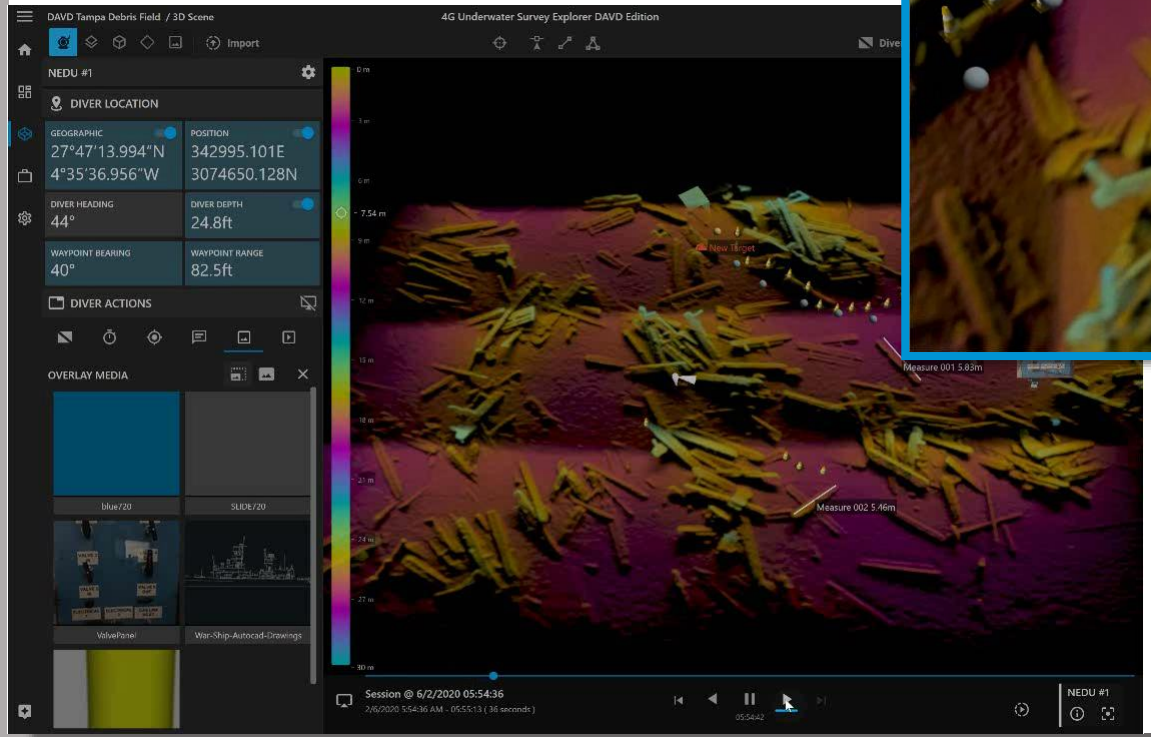
Live Dive Supervisor View



Live Diver View

Diver **A**ugmented **V**ison **D**isplay System

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Summary of Benefits and Features from the DAVD system

- **Transparent Glass Display** capable of 2D Data, 3D Augmented Reality and Mixed Reality
- **Diver DPP** "**Black Box"** high performance processor for diver display, sensor fusion and real-time data recording and acquisition.
- System provides a complete **Underwater Diver Information Portal**
  - Technical Data
  - Drawings, Pictures Georeferenced Maps
  - Workflow Missions – Slide Decks
- **Communication and Messaging** – Text, Symbology and Visual
- **Software Simulation** – Critical software feature for Pre-Deployment and Pre-Dive planning, scene augmentation and diver familiarization leading to mission safety and efficiency

Thank You!

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QUESTIONS?

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blair.cunningham@codaoctopus.com