Utilizing Precision Navigation and Autonomy to Support Combat Diver CONOPS



STIDD and Greensea Partnership

STIDD – EXPERTS IN DIVER PROPULSION

• Producing military submersibles since 1998



- Most widely used two-man underwater mobility platform in the world
- Extensive customer-base: United States Marine Corps, Special Operations Command, Coast Guard, and Coalition Forces
- STIDD continues to offer SOF and Marine units the latest technology to counter today's increasingly asymmetric and unpredictable maritime threat environment

GREENSEA – EXPERTS IN NAVIGATION & AUTOMATION

- Founded in 2006
- Patent-pending OPENSEA technology—the first commercial software framework for the marine industry
- Leading provider of commercially available navigation, control, and automation products for marine with over 800 systems in the field
- Spanning the marine industry—unmanned, manned, surface, and subsea





Greensea develops technology to improve the relationship between man and machine to make the work they do together more productive.

MAN AND MACHINE ENGAGEMENT

> OPENSEA SOFTWARE FRAMEWORK

MANNED - UNMANNED SURFACE - SUBSEA

NAVIGATION

CONTROL

INTERFACE

Vehicle Types Utilizing Greensea

Miniature ROVs





Vessels

AUVs / Gliders





Submarines









Distribution B. Other request for this document shall be referred to Greensea (mbgilliam@greensea.com).

STIDD RNAV2 AP2 Diver Propulsion Device

The Realm of the Combat Diver

COLD LIMITED TO NO VISIBILITY UNDERWATER OPPOSING FORCES DARK

Tasks:

Infiltration & Exfiltration for: Amphibious Assaults High Value Target Operations Clandestine Surveying Special reconnaissance Subtasks: Swimming Navigating Vehicle Piloting Warfighting specific tasks



More machines = more tasking

Depth Gauge Compass Vehicle Controls (Yoke and Throttle) Charts, Routes and Waypoints Sonar Alarms and Warnings **Battery Life Indicators Divers Air Gauge**



Quintessential AI Conversion

Minsky

"We're going to make machines intelligent."

We are going to make them conscious!"

Engelbart

"You're going to do all that for the machines?

What are you going to do for the people?"

Diver Focused Product Development

A development team of engineers and operator-divers with regular diving responsibilities during the year for testing.

> Test early Test often Listen carefully



STIDD RNAV2 AP2 Diver Propulsion Device (DPD)

A Greensea System

OPENSEA Software Framework





RNAV2 Diver Navigation System

- Inertial navigation system (INS)
- Sonar interface
- Mission planning
- Mission execution

Diver Propulsion Device (DPD) with AP2

- Autopilots
- Automation

STIDD RNAV2 Interface

w/ Fully-Integrated Navigation & Control





Increase Diver Bandwidth by Simplifying Subtasks

What are you going to do for the people?

Automate piloting the DPD so the diver can navigate and use the new capabilities provided by RNAV2.

- Combine manual operation with electronic fly-by-wire
- Add autopilots
- Add automation
- Add remote capability to automation
- Add surface and subsea communication



Simplify piloting



Heading lock Depth lock Fly-by-wire Full Autopilots



Simplify piloting



Steering is shifted to simple thumb movements





Simplify navigating



Autopilot:

Waypoint and route following

Less steering, more situational awareness



Task & Mission Planning



GREENSEA

Simplify Task Execution



Use offline planning software to pre-load routes, search patterns, notes

Embed task functions within software (loiter, sonar relative, virtual anchor)

"Man overboard" button to capture all data and screenshot at a given instance



Acoustic Communications





Teammates visible on screen Encrypted text messaging Team broadcast or peer-to-peer communications Beacon homing Mission and objective modification



Optionally Manned



Fully autonomous functionality on DPD with RNAV2 OM2 system.





Autonomous INFIL/EXFIL







Unmanned DPD material delivery







Unmanned DPD conducts hydrographic survey of area, returns to home base, and picks up divers for infiltration using info gained from survey





Technology for man and machine

The implementation of autonomous and supervised autonomous functions does not eliminate the need for the Combat Diver.

Developing and improving the diver's relationship with the technology allows the diver and the vehicle to meet their full potential and opens paths to safer and more efficient operations.

- The diver has more bandwidth available for the combat-related tasks.
- The diver and tactical commander can more efficiently implement contingency plans.



Acknowledgements





Thank you to STIDD Systems, Inc. our manufacturing partner for RNAV2 AP2.

www.stiddmil.com

Thank you to all the divers who have evaluated the RNAV2 AP2 OM2 product and provided valuable, honest feedback.



Thank you

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