Using MANTAS T12-MCM Solution for

Mine Countermeasures Detection System

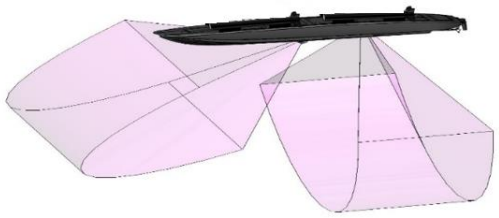
Maritime Tactical Systems, Inc. (MARTAC)
511 N. John Rodes Blvd
Ste 103
Melbourne, FL 32934 United States

Proposed Solution Summary

MARTAC, in our MANTAS T12-MCM USV (herein "T12-MCM") configuration, provides a technically mature Unmanned Surface Vessel (USV) as an option for mine countermeasure detection. The T12-MCM configuration consists of a MANTAS USV system, a L3 KLEIN UUV-3500 High Resolution Side Scan Sonar and a NORBIT Wideband Multibeam Forward Looking Sonar. These technologies combine to a provide mine detection and real-time relay capability back to a shipside or shoreside monitoring and control station and operators.

Background and Benefits of Proposed Solution

The MANTAS USV product line was developed using a flexible, modular, open architecture strategy focused on the capability to build and launch MANTAS variants that address mission requirements. The MANTAS USV product line are currently or will be available in the future in the following variant sizes: 6 ft (2 m), 8 ft (2.5 m) , 12 ft (3.6 m), 24 ft (7 m), 38 ft (11 m) and 50 ft (11 m) versions. (herein "T6", "T8", "T12", "T24", "T38" & "T50", respectively) Currently the T8 and T12 are in LRIP and available for operations, while the remaining variants are in design.



MANTAS T12-MCM with Forward Looking Sonar (FLS) and High-Resolution Side Scan Sonar

Depending on the variant and launch & recovery (L&R) system, MANTAS USVs can be launched from shore, small craft or directly off a ship deck. For mine countermeasure detection mission, MARTAC recommends the MANTAS T12 USV, which can operate at slow, ISR or underwater detection speeds as well as have the capability to increase speed to proceed to its next mission location. The modularity and scalability of the MANTAS USV design allows rapid payload conversions to be performed in a short time by removing and replacing payload panels/hatches within its high-performance catamaran hull.

MANTAS USV Vessel

At the core of the T12-MCM system is a custom MARTAC-designed and built MANTAS 12 ft (3.6 m) variant. The MANTAS T12 is a lightweight electric propulsion, carbon fiber body USV based on a patented aerodynamic/hydrodynamic catamaran hull designed for stability and superior maneuverability at higher

speeds. MANTAS hulls have endured hundreds of hours of runtime, are self-righting, and proven to operate and survive in high seas.

Today's MANTAS T12 USV is a 4th generation Low Rate Initial Production (LRIP) system with associated high reliability hardening, low maintenance modular engineering, a complete companion C2 system (TASKER) and a comprehensive Mission Command Center (MCC).

MANTAS T12 USV Specifications

MARTAC MANTAS T12 specifications are as shown in the table. Key components include the following:

- Ruggedized Carbon Fiber Hull
- Modular Deck Design with four identical easy-to-open hatches
- Twin screw surface drive– independent electric motors
- Onboard Vessel Control System (VCS) with open-architecture design criteria
- Automated Self-Righting System
- IP67 Waterproof LRU modules
- BMLMP Battery Packs

Specifications	MANTAS T12
Length	12 ft (3.6 m)
Width	3ft (0.9 m)
Height	14 in (0.36 m)
Draft	9 in (0.23 m)
Weight	260 lbs (117.9 kg)
Max Payload Wt	140 lbs (63.5 kg)
Performance	
Propulsion	Twin Screw
Burst Speed	25 kts @ min load
Cruise Speed	8-20 kts
Ocean Sea State Capable	4+
Cruising Range	>35 nm *Solar Capable*

MARTAC has created the MANTAS class using a proven C2 system that allows operation in full control, semi-autonomous and autonomous modes. MANTAS USV capabilities include coverage in open ocean, and littoral waterways as well as support for special operations and expeditionary missions in riverine and harbor focused waterways.

MANTAS Autonomy

The MANTAS USV has significant general autonomy functionality, operable in a number of modes:

- Full MANual Control: Manual operation by an operator using a hardened laptop (MCC), tablet (TCU) or Ground Control Station (GCS)
- SEMI-Autonomous: Operator assigns either (1) WAYPOINT, where a specific point on the chart is selected for the MANTAS to proceed to or (2) HEADING, where the operator assigns a heading to proceed on. In both cases, the operator assigns the speed to proceed and the craft will stop and hold at its waypoint, if that option is chosen.
- AUTOnomous: A pre-programmed autonomous track is set up for the MANTAS to follow, using waypoint navigation. The mission track scenario is programmed via the MCC laptop and downloaded onto the Vessel Control System (VCS) of the MANTAS for commanded execution

In both the SEMI and AUTO operable modes, the operator has the option to intervene and redirect the MANTAS at any time. In the case of the AUTO, when the redirection is completed (i.e. investigation of a contact of interest), the operator can redirect MANTAS to resume its AUTO mission.

Real-Time Display

The MANTAS USV can be programmed for autonomous or semi-autonomous missions within shallow water areas. During these missions, the scanned sonar data can be relayed, via a wide bandwidth communications system, directly to a control center either onboard the MANTAS, a mother ship or to onshore operator and/or command center. Sonar data can be monitored real-time for detection of

potential military grade in-water or bottom-located anomalies. Upon initial detection, the MANTAS USV can be further positioned to perform a more detailed bathymetric imaging of the questionable area for possible real-time identification.

L3 Klein UUV-3500 High-Resolution Side Scan Sonar

Designed to be compact, lightweight and using low power, the UUV-3500 was designed specifically for Unmanned Vehicles. This side scan sonar features real-time, dual simultaneous frequency operation at both 455 and 900kHz and provides detection of medium-to-large size objects at ranges exceeding 175 meters (350 m total swath), while the 900kHz provides the highest possible resolution at over 75 m range (150 m total swath). The sonar engine simultaneously optimizes two different and concurrent output data streams for (1) photo-quality side scan imagery and (2) optional high-accuracy, co-registered swath bathymetry.

NORBIT Forward Looking Wideband Multibeam Sonar (FLS)

This wideband multibeam echosounder technology is an augmentation sonar allowing for long range imaging forward of the MANTAS craft. While it does not have the highly accurate GNSS/INS positioning or 3D resolution of the side scan, it has a range of detection up to 250 m, allowing it to be a "look ahead" sonar to initially define potential military grade anomalies that can then be further scanned, under high resolution, with the Klein UUV-3500 side scan sonar.

Possible T12-MCM Requirements and Methodology

Following is a technical summary of how the T12-MCM could be utilized as an MCM detection system in littoral environments

1. Detection of mine type objects in the littoral zone from very shallow water near the surf zone to max sonar detection depth (175 m)

    a) The MANTAS T12 USV, in its catamaran configuration has a draft of less than 10 inches (25 cm). Installing the Klein UUV-3500 Side Scan Sonar and Norbit Forward Looking Sonar increases that draft to approximately 2 ft (0.61 m). These sonar kits, at minimum require an additional 2 ft (0.61 m) to acquire usable imagery. Based on these requirements, the T12-MCM can operate, and receive imaging data in as shallow as 4 ft (1.22 m) depth.

    b) The MANTAS T12 USV has successfully transited a surf zone both inbound and outbound, however it is not designed to operate autonomously within the actual surf zone. The craft can effectively operate up to the area where the energy dissipation (breaking waves) begin.

    c) The MANTAS T12 USV has integrated and successfully performed underwater object detection scans utilizing a Teledyne Reson T20 Multibeam Echosounder and NORBIT iWBMS STX Multibeam Echosounder. Both these kits were used for dam and bottom imaging missions. During these missions, scanned images and bathymetry were sent to an operator in a real-time environment using broadband communications. Due to the large amount of data points from multibeam scans, these larger sonar kits required post-processing for clear and distinct imaging. Since a key requirement of a mine detection mission is to detect mines in real-time, MARTAC recommends integrating the Klein UUV-3500 high-resolution side scan sonar into the T12-MCM enabling the direct high bandwidth transmission of the sonar view back to a control station in real time. If required, this data can be further analyzed by operators. With a high-resolution monitor at the

control station, anomalies of military interest can be identified by the operator on these scans in a real time environment with side scan sonar kits.

d) The T12-MCM utilizes the Forward-Looking Sonar to provide a forward scanning capability. Once a target is identified, the operator could perform follow-up high resolution scanning with the UUV-3500 side scan sonar to further detect and identify mine shaped structures.

2. Navigation to avoid obstacles within the littoral zone

a) The T12-MCM could be integrated with a LIDAR collision avoidance system (CAS) to avoid above surface obstacles. The Norbit Forward-Looking Sonar provides an adjunct capability below water, near surface collision avoidance.

b) Both these CAS capabilities would be remotely operated, via onboard communications link, and functional in all operational modes: remotely piloted/controlled, semi-autonomous and autonomous.

c) The T12-MCM could also include a FLIR Thermal PTZ camera for visual obstacle identification.

3. Maintains accurate geo-location less than one-meter for navigation and position marking of mine shaped items detected

a) The T12-MCM uses a high accuracy GPS module for geo-location and could provide less than one-meter accuracy.

b) MARTAC is currently upgrading our GPS capability to a new high precision GNSS module and is beginning the process of integrating it into the MANTAS T12. This new GNSS multi-band receiver will provide centimeter-level accuracy in seconds through concurrent reception of GPS, GLONASS, Galileo, BeiDou and QZSS. This upgrade will serve to further improve the currently available accuracy.

4. Comms redundancy and emergency location and recovery to counter lost comms

a) The MANTAS T12 USV already incorporates the Iridium SBD comms for emergency command and control if other Line of Sight or Beyond Line of Sight comms are lost.

b) Normal operation of the Iridium SBD is from the C2 Battery Module and it contains a small backup battery that provided power in the event comms and C2 power is lost.

c) Upon such event detection, the Iridium SBD immediately goes into a lost comms/recovery mode transmitting its current/last GPS position to the control center. These transmissions repeat on 15-minute intervals until the battery is expended or the craft is recovered.

5. The MANTAS T12 USV system can integrate with Government-owned Command and Control (C2) systems

a) The MANTAS T12 USV operates in (1) Manual, (2) Semi-Autonomous and (3) Autonomous modes. Manual mode is a remote-control evolution whereas the Semi-Auto mode allows the controller to set a waypoint or a heading to which the MANTAS T12 USV executes. The autonomous mode is a waypoint-following autonomy allowing the controller to preset actions at each waypoint within a autonomy mission scenario.

b) MARTAC has demonstrated the ability of the MANTAS T12 USV system to integrate into U.S. Government-owned C2 systems and architectures.

6. The MANTAS T12 USV can be launched and recovered from a small boat such as the Combat Rubber Raiding Craft (CRRC) or small Harbor Patrol Craft.

a) The MANTAS T12 USV with sensor package integration weighs in at approximately 350 lbs (159 kg). This configuration is portable by 3-4 personnel and normally stored on a large table or pushed on a transit-wagon indoors. In AOR, it is transported by a modified "SeaDoo" type trailer which can also be used for launching on a boat ramp similar to launching other small craft.
b) The MANTAS T12 USV has successfully been launched from a small amphibious craft from either a bow ramp or stern ramp. In this scenario, the launch and recovery could be performed by two personnel. It has also been launched, but not recovered, from a harbor patrol craft.
c) MARTAC has developed multiple storage and launch & recovery devices to augment mobilization and demobilization of the MANTAS T12 USV from different platforms (11m RHIB, Harbor Security Boat, etc), MARTAC has the confidence that a storage, launch and recovery device can be designed to allow the deployment and recovery by two personnel.
d) The MANTAS T12 has successfully launched and recovered from a U.S. Military Sealift Command Ship

Conclusion

Combining leading edge USV technology of the MANTAS T12 USV with state-of-the-art sonar technologies can provide an efficient, simple to use system for mine countermeasure detection. The flexibility of T12-MCM allows it to operate in varying AORs and deployed across different platforms.