

Next Generation Submersible Boats for Global Maritime Special Operations

Sub-Boats for SOF: A New Approach for Surfaced and Submerged Operations

Tracking the Trend in Littoral and Maritime Operations

The Understated Presence of Special Forces in 21st Century Warfare

The Defence of South Asian and other Coastal Metropolitan Areas

Submersible Boats in Action and the Future

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Diver Propulsion Device



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Multi-Role Combat Craft

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Foreword

Special Operations Forces like to keep out of the headlines. Their world of covert operations, difficult assignments and high strategic importance is shrouded in secrecy and mystique. However, tools for their craft that offer 100% reliability and yet the agility and flexibility that their operations require are always in demand. In the United States the SEALs have a deserved reputation for daring, courage and accomplishment and companies that provide them with the sophisticated equipment they need will undoubtedly have an appeal to states that are entering the market to defend their long coastlines and littoral metropolitan developments from insurgents or violent radical extremists.

This Special Report opens with an article that looks at the increasingly important role played by Submersible Boats (Sub-Boats) in a wide spectrum of SOF missions ranging from asymmetric threats such as piracy and drug smuggling to traditional tasks such as Visit, Board, Search, Seizure (VBSS) and harbor penetration. Of no less importance is the task of delivering SEAL type units to their objectives. In this connection, STIDD Systems Inc., working with the United States Special Operations Command (USSOCOM) has developed a SEAL insertion vessel, known as a Multi-Role Combatant Craft (MRCC), with the capability of both a surface planning boat and the clandestine aspects of a submarine. Another, smaller Sub-Boat developed by STIDD for USSOCOM is the Diver Propulsion Device (DPD), which allows transport of two fully equipped combat divers and additional equipment to go on long range missions. These innovations can provide economical, efficient solutions to the variety of threats and challenges facing Naval Special Forces today.

The second article looks at the changes in 21st century naval warfare and assesses how insurgent threats from the coast have altered the role of the navy and demanded new thinking from maritime commanders.

Despite their low news profile, Special Forces have had a new and enhanced role in recent campaigns because of their ability to disappear into the background. Modern Western democracies now seek to avoid committing soldiers on the ground in any conflict that might drag them into protracted operations. However, special forces, often described as advisers, have the ability to move into and out of rapidly changing situations and deliver the intelligence or communication equipment that are needed. This is the theme of the third piece.

It was the November attack on Mumbai in India that has been the catalyst for a great deal of rethinking of the role of counter terrorism and protection of metropolitan states in coastal areas. This attack and its high impact in global news media is the type of incident that many emerging states seek to avoid. China is a case in point and the recent debate in the Party Congress illustrates new Chinese thinking on the importance of protecting and surveying their long coastline.

As always the report glimpses at the future. While new technologies may or may not come to fruition and a useful role in the armed forces, what is clear is that, in the short to medium term there will be a place for niche capabilities like submersible vessels.

Mary Dub
Editor

Mary Dub has covered the defence field in the United States and the UK as a television broadcaster, journalist and conference manager.

Sub-Boats for SOF: A New Approach for Surfaced and Submerged Operations

STIDD Systems, Inc.

Sub-Boats outfitted with the latest technical innovations are redefining what is possible for International Naval Special Forces responsible for combating asymmetric and traditional maritime threats.

IT'S NO secret that Special Operations Forces (SOF), especially the naval variety (NAVSOFF), are enjoying unprecedented success in and out of the water. From the Bin Laden raid to on-going anti-piracy operations, Navy Commando units from around the world continue to exceed expectations in accomplishing their assigned missions.

Given this new reality, it's safe to assume that NAVSOFF utilization will continue to grow as the United States "pivots" toward Asia. This region is not only full of water, but also populated with countries eager to modernize their SOF units to protect various Pacific Rim territorial claims. A similar NAVSOFF modernization push is underway in the Middle-east, Central Asia, and Latin America. Militaries over the world have come to appreciate the 'bang for the buck' that SOF provides and, with 4/5ths of the world covered with water, Naval Commandos are poised to play a more important role in operations above and below the water.

It follows then that the equipment, especially the boats SEALs use, must be optimized for an increasingly diverse set of SOF roles and missions to include: asymmetric threats like piracy and drug smuggling to more traditional tasks like Visit, Board, Search, Seizure (VBSS) and harbor penetration. Outfitted with the latest cutting edge technical innovations, Submersible Boats (Sub-Boats) offer International NAVSOFF an unprecedented, efficient, cost effective, and multi-role capability to counter these threats.

Minding the Gap

Around the world today's SEAL type units have two options when approaching objectives from over the horizon while underwater: combat swim/dive with the obvious associated drawbacks, or use a Swimmer Delivery Vehicle (SDV) like the US and UK Navies operate. These types of

SDVs, while clearly a better option than swimming, do require a submarine with a piggy back Dry Deck Shelter (DDS) to enable their delivery to the Area of Operations (AO). On the surface SOF use a wide variety of boats all of which have significant visual, auditory, radar and other signatures. The need to fill this gap between the limitations of current SDVs and the restrictions of surface craft led the United States Special Operations Command (USSOCOM) in partnership with the American firm STIDD Systems Inc. (STIDD), to develop a SEAL insertion vessel with the capabilities of both a surface planning boat and the clandestine aspects of a submersible.

A True Hybrid: The Sub-Boat Defined

STIDD evolved the original design of the USSOCOM initiative into the current COTS Sub-Boat known as the Multi-Role Combatant Craft (MRCC). Occupying a sliver of the naval maritime marketplace, the MRCC is in essence a compromised hull form that serves as both a viable surface craft and a self propelled wet-submersible. The MRCC is not a submarine, nor a semi-submersible "narco" style sub. Rather, it neatly combines the capabilities of an SDV with that of a Surface Boat resulting in a hybrid craft capable of long range, high speed surface insertions AND medium range, low signature submerged transits. The MRCC can also operate in a semi-submerged mode and can be "cached" on the bottom for extended periods. The real "killer app" for NAVSOFF operators is that with an MRCC Sub-Boat they avoid not only the complicated SDV launch/recovery and exposure to water during transit, but also the high signature of non-clandestine surface craft. Unlike an SDV or surface boat, the MRCC can operate in four distinct modes:

MRCC

Multi-Role Combat Craft

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Innovative Surface &
Submerged Craft



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of the naval maritime
marketplace, the
MRCC is in essence a
compromised hull form
that serves as both a
viable surface craft
and a self propelled
wet-submersible.*

Surface -craft operates in typical surface planning mode with diesel / waterjet propulsion.

Semi-submerged -craft operates partially submerged (bow-forward), using surface propulsion with reduced freeboard. The only visible structure is the top-skin.

Submerged -craft submerges and operates underwater using electric propulsion.

Cache -craft sinks to the bottom: operators and crew egress craft, anchor to bottom, and conduct actions on the objective.

delivered from lithium batteries powered by highly efficient Electric thrusters.

Sub-Boat Specialty: New NAVSOF Missions

What's also obvious to SEAL operators is the high mission utility of the MRCC, especially when it's complemented with STIDD's other, smaller Sub-Boat, the Diver Propulsion Device (DPD). The DPD, also developed by STIDD for USSOCOM, enables the transport of two fully equipped combat divers and additional equipment on long range missions.

The DPD's interior cargo payload capacity, high accuracy onboard mission planning / submerged navigation system, and ability to convert from a deployed rapid operation mode to a stowed lightweight space-saving transportation mode, have made it the Diver Propulsion Vehicle (DPV) of choice for SOF units worldwide.



MRCC UNDERWAY IN SURFACE MODE



MRCC TRANSITIONED TO SEMI-SUB MODE



MRCC DURING SUBMERGED TRANSIT



MRCC IN CACHE MODE ON BOTTOM



DPD UNDERWAY WITH TWO COMBAT DIVERS



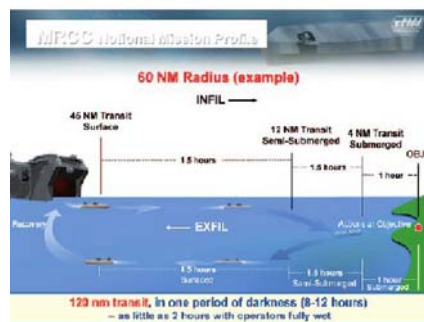
DPDS LAUNCHING FROM MRCC

One operational scenario now possible with the MRCC/DPD Sub-Boat combination involves using the MRCC in all of its modes for an unprecedented long range, low signature Maritime SOF mission. In this profile, up to 8 SEAL operators begin with up to a 200 nautical mile (nm) MRCC surface transit.

When the Sub-Boat nears the point of insertion, it travels semi-submerged or fully submerged to avoid detection. The buoyancy control system allows it to sink, become neutral, or resurface with a turn of a valve. In this scenario, after a semi-submerged run, the boat submerges, moves undetected for up to 40 nautical miles, and then is positioned on the sea bottom. At this point, with the MRCC static and fixed to the sea-bed, operators launch the on-board DPDs for final

On the surface and semi-submerged, MRCC power is delivered by a turbo-diesel waterjet propulsion package in a patented "Engine-Room-in-a-Can" pressure proof container, resulting in long range and reduced acoustic and thermal observability. Submerged power is

actions on the objective before returning to the MRCC for the exfiltration run.



MRCC NOTIONAL MISSION PROFILE

Due to the reduction in time, the fact that operators are fully submerged and the reduced signature of semi-submerged and submerged modes, this type of operational profile, impossible with only an SDV or surface boat, represents the type of game-changing approach to NAVSOF missions that MRCC Sub-Boats enable.

Aside from this type of operation, the MRCC, with or without the DPD, can execute the full spectrum of NAVSOF missions to include:

- Underwater Reconnaissance Insertion and Extraction
- Non-Combatant Evacuation Operations Maritime Interdiction Operations
- Intelligence Collection Visit, Board, Search and Seizure (VBSS)
- Harbor Penetration Low Profile infil/extraction of non-swimmer
- Ship attack, tagging, tracking, locating Sensor emplacement and monitoring
- Submerged cache for extended operations ashore

These types of missions and others are further facilitated by MRCC's unusually high level of operational responsiveness. MRCC can be launched via a variety of methods to include basic, low profile/low resource land launch, in some instances requiring only a truck and trailer, to a more sophisticated airdrop/mother craft launch. The MRCC can also be transported in a 40ft ISO Shipping Container.

New Sub-Boat Technical Innovations

Nearly 20 years ago STIDD started working closely with the Naval Surface Warfare Center, Panama City (NSWC PC) and USSOCOM to apply the latest technology and expertise to the design and manufacture of manned submersibles for the Advanced Seal Delivery System (ASDS) and other military applications. Over the years STIDD has retained key retired

Navy and SOF submersible engineering and Naval Special Warfare (NSW) SDV operations personnel. This unique combination of submersible engineering and SDV operational experience have enabled STIDD to continually develop, guided by operator input, breakthrough technical improvements resulting in better Sub-Boat performance. Additionally, with over 400 Sub-Boats in operation with NAVSOF units around the world, STIDD constantly incorporates user feedback into its next generation Sub-Boats.

Specifically, the DPD, while maintaining all of its hard earned US Navy Certifications to include Approved for Navy Use (ANU) listing, SOF Carry-On Authorization, and US Navy 9310 Authorization, is now available in an Extended Range and Dual Thruster (DPD-XT) models.



DPD DUAL THRUSTER (DPD-XT) MODEL

As of 2012, all DPD models are also available with a Tecadine (TEC), high efficiency, light weight brushless thruster which radically improves DPD speed and range. In response to its global SOF customer base, STIDD also recently introduced the Ergonomic Upgrade Package (EUP). The EUP is a family of DPD upgrades ranging from quick release Exterior Cargo Tie Down Points to integrated Rear Tow Points that enable additional personnel and equipment to be towed behind the DPD.



DPD WITH EUP AND TEC THRUSTER

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craft launch.*



MRCC SUBMERGED CONSOLE WITH IBS

When these innovations and updates are combined with the DPD's "MUSCLES" battery, which was designed to give the craft a better performing, higher value, maintenance free power source, the DPD is transformed into a proven, reliable ¼ scale version of an SDV at a fraction of the cost.

The MRCC has also enjoyed a transformative upgrade most notably with a new COTS Integrated Bridge System (IBS) that includes:

- Flat Screen Multi-Function Displays (MFD)
- Submerged Diver Velocity Log (DVL)
- Obstacle Avoidance Forward
- Scanning Sonar (OAS)
- Diver/Surface Communications
- Submerged Speed and Air Pressure Displays
- Deployable Electronic Mast w/
- GPS/VHF Antennas

STIDD has also integrated crew and passenger seating as well as numerous other ergonomic upgrades making the MRCC the most technically advanced Sub-Boat available on the market.

Sub-Boats offer NAVSOF New Options

In many ways, the Sub-Boat is the perfect solution for NAVSOF units charged with executing increasingly varied missions. For units that already operate existing SDV and Surface Boat assets, the Sub-Boat could either replace or at least significantly augment these platforms. For other units just starting to modernize their capabilities, next-generation Sub-Boats like STIDD's DPD and MRCC could provide economical, efficient solutions to the myriad new threats and challenges facing Naval Special Forces.

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Tracking the Trend in Littoral and Maritime Operations

Don McBurnet, Staff Writer

"Although financial constraints make a thousand-ship navy unlikely for any nation, our community of nations can unleash the potential of the thousand-ship navy right now." Vice Admiral John Morgan Jr1 Deputy Chief of Naval Operations and Information, Plans and Strategy



MRCC IN SUBMERGED MODE

21ST CENTURY sea power has to confront a complex array of challenges. There is an element of continuity with the role of the navy in the past but many critical features are very different. As Vice Admiral Maddison, Commander, Royal Canadian Navy speaking at the United States Naval War College said on 21 July 2011. "Over the past twenty years, operations ashore have been conducted against adversaries who have learned with increasing effectiveness to blend all forms of violence – ranging from the purely criminal through the irregular to the conventional – for a political purpose, while using superior knowledge of their local physical, social, and cultural terrains to fight from a position of maximum relative advantage. Such adversaries have not yet mastered the maritime domain to the extent required to challenge modern navies."

However, as he points out, the trend toward improved capabilities and competence at sea by insurgents is clearly evident in some notable recent incidents: the suicide attack on USS Cole in 2000; the attack by al-Qaeda on the French oil tanker Limburg in 2002; Hezbollah's attack on the Israeli corvette Hanit using a variant of the Silkworm anti-ship missile in 2006; and terrorist attacks launched at Mumbai, in 2008, from the sea.

Vice Admiral Maddison highlights that the littorals, the relatively narrow zone on the world's coastlines, have been the location for high levels of population growth. But equally importantly they are the location of massive social change and disruption. It is these littoral areas that will be the locus of future sea-land-air special operations and political and military challenges to authority, as he sees it.

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Advanced Electronic
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*Western Europe sees
its influence wane
with the decline in its
economic fortunes,
and slow growth in the
United States means that
the 'declinist school'
can argue that the
pre-eminent position
of the United States in
international affairs can
be challenged by China.*



DPDS UNDERWAY IN FORMATION

The Battle for the Strategic Narrative and New Naval Weaponry

Control of the sea is as important as controlling the strategic narrative of a conflict which gives legitimacy and authority to the forces of the state to use power and campaign to quell the adversary. The 21st century adversary is using new versions of naval weaponry, for example, "swarming" attacks, using relatively unsophisticated but very fast and highly maneuverable speed-boats in large numbers, armed with optically sighted handheld weapons. Others may employ shore-based rocket artillery, and some may have access to subsonic but capable anti-ship missiles that can be launched from commercial vehicles ashore. These weapons may be complemented by highly advanced weapons launched at sea and from ashore, including hypersonic anti-ship missiles and very fast, supercavitating torpedoes. (Super cavitation is the achievement of high speeds in water by the creation of a bubble of gas large enough to encompass the object travelling through the water, thus facilitating increased speed.)

The Rise of China's National Maritime Claims

The 21st century also marks a shift in global power. Western Europe sees its influence wane with the decline in its economic fortunes, and slow growth in the United States means that the 'declinist school' can argue that the pre-eminent position of the United States in international

affairs can be challenged by China. And there is evidence that, over the last decade, China has begun to flex its naval muscles and assert its presence to defend its economic and national interests in the Pacific region. In the opening session of the Chinese communist party's 18th National Congress, China's outgoing President Hu Jintao called for China to "resolutely safeguard China's maritime rights and interests and build China into a maritime power." Beijing has been paying more attention to its maritime interests in the past decade and has used its burgeoning economic strength in establishing China as a regional naval power. Double-digit defence spending increases over more than a decade have been used to modernise China's navy. Non-military departments such as fisheries and maritime surveillance have seen their fleets modernised and expanded.² Kathrin Hille of the 'Financial Times' notes that China has maritime territorial disputes with Japan around the Senkaku Islands, and with Vietnam, the Philippines, Brunei and Taiwan. In a parallel development, the United States is increasingly redefining itself as an Asia-Pacific power that is vested deeply in regional stability and security. Secondly, the United States covets the role of the world's preeminent maritime power,³ although this may not reflect its current economic capability or new presidential aspirations.

The Significance of this Strategic Shift

While these strategic changes may appear distant from the global market, for a new generation of submersible boats for use in special operations they point towards where the global market has the greatest potential demand to defend its coastline from attack. The Asian nation states with extended archipelagos and coast lines along Pacific rim countries, where there are historic disputed territories with on-going conflicts between religious groupings, may be the focus of global demand for new technologies for special operations forces. Similarly, Australia and the Middle Eastern and Gulf States with strong economies and long coast lines are a greater potential market than the countries of Western Europe trapped in an era of austerity.

The Understated Presence of Special Forces in 21st Century Warfare

Mary Dub, Editor

*"A war-at-sea strategy's purpose is to provide U.S. political leadership with less intrusive ways to deter war and inspire allied engagement in peace. It is a maritime strategy confining conflict to the sea without land invasion or strike, thereby diminishing the threat of escalation. The strategy affords leadership the means to reinforce any relationship between the United States and China, whether co-operation, competition, confrontation, conflict short of war, or war."*⁴

Jeffrey E. Kline and Wayne P. Hughes, Jr. US Naval War College Review (2012)

THE CENTRAL problem about writing about amphibious Special Operations is that they are almost exclusively secret or classified. Governments do not comment or report on their activities and frequently deny their presence when challenged by the press. However, since the 2011 campaign in Libya "Operation Unified Protector", there has been a stated new strategy, first for the United States to lead from behind a coalition or ad hoc group and secondly, and more importantly, to actively avoid the commitment of soldiers on the ground. What does this mean for the role of Special Forces? Although Special Forces are the highest trained soldiers/marines in Western armed forces, their presence is often reported as 'advisors'. Their role is highly targeted and frequently covert, to provide intelligence (HUMINT), to aid communications (by bringing equipment to key installations) or by protecting or removing key individuals and leaders. "Most UK forces during this period were used to gather human intelligence to improve target identification and to infiltrate Tripoli, planting supplies and undertaking psychological operations, with the aims of aiding on-going planning for the rebel advance and also facilitating the advance when it eventually came."⁵

The Unique Contribution of Amphibious Special Forces in Libya

In his assessment of the role of Special Forces on the ground in Libya, Shashank Joshi, Associate Fellow, RUSI, notes the effective contribution of

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amphibious forces from the coalition of states working under UN Security Council Resolution 1973. "Western and Arab special forces from the US, Britain, France, Qatar and Egypt are likely to have trained and otherwise assisted rebels through the summer, and played a key role in preparing Tripoli for its capture. The tactical proficiency of the amphibious force that assaulted Tripoli in August hints at this effort."⁶

The French Perspective on the Role of the Navy and its Amphibious Special Forces

In a succinct summary of the role of French Naval forces and Special Operation amphibious

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The sea lanes and littoral areas are an important route for terrorist organisations to transport their personnel, their weapons and their illegal shipments which fund many of their activities.



DPD TRANSPORTED BY TWO PERSONNEL



RNAV IS AN ELECTRONIC NAVIGATION SYSTEM FOR THE DPD

forces in the 21st century, Vice Admiral Pierre-François Forissier outlines the role of the modern French navy. He views the sea as a naturally permissive environment, coveted by all sorts of criminals as it is insufficiently regulated and does not have the same legal basis as other environments.⁷ He notes a radical change modifies the scope of naval operations, which now cover a wider spectrum, in Joint, interagency or coalition frameworks. They are no longer limited to the control of pre-defined oceanic spaces. They are carried out at sea but also, and everyday more so, from the sea against land, against a country disrupting world or regional balance, as well as from land toward the sea, mainly to enforce laws and to crack down on illegal trafficking. So the French navy has a role in prevention, power and force

projection and finally, but most importantly, fighting illegal trafficking and immigration, and carrying out specific police operations and rescue at sea. As can be seen, the scope for using amphibious vessels is wide.

Amphibious Special Operations and the Royal Navy

The British Royal Navy might use a similar term to the French, but it expresses it as keeping the sea lanes open. Because ninety per cent of Britain's trade moves by sea, keeping the oceans free is vital to the prosperity of our nation. As a maritime nation, the UK's economic prosperity depends on seaborne trade travelling safely through a network of international sea lanes.⁸ Acts of terror are almost always committed on land – but terrorist organisations use the sea lanes to move themselves and their weapons, and to raise money for their activities through smuggling. In a key change in the 21st century, one of the key roles of the Royal Navy is to counter terrorism –that is, to prevent the movement of terrorists, their weapons and their illegal fund-raising activities on the high seas. The sea lanes and littoral areas are an important route for terrorist organisations to transport their personnel, their weapons and their illegal shipments which fund many of their activities. There are estimates that 90 per cent of all the drugs produced in Afghanistan are eventually transported by sea and the money raised helps fund the insurgency. In a related area, counter narcotics, much of the effort is focused on the Caribbean with a destroyer, frigate, or RFA guard ship, working hand-in-hand with the US Coast Guard to intercept drug-runners. The traffickers typically use 'go fasts' – speedboats packed with petrol and drugs – hoping to outrun the authorities or else try to hide their evil cargo in tugs and fishing boats. In addition to the counter-narcotics effort in the West Indies, Royal Navy warships are committed on the a sea-lane in the western Indian Ocean off the Pakistani coast commonly known as the 'Hashish Highway'.

The Defence of South Asian and Other Coastal Metropolitan Areas

Meredith Llewellyn, Lead Contributor

"The highest realization of warfare is to attack the enemy's plans; next is to attack their alliances; next to attack their army; and the lowest is to attack their fortified cities."

Sunzi 'The Art of War' 544 BC



MRCC UNDERWAY IN SURFACE MODE

IT WAS the attack by the radical Islamic group Lashkar-e-Taiba, on central Mumbai, India on 28-29 November 2008, that alerted the world to the threat of attacks from the sea to major coastal metropolitan areas by radical insurgents. 164 people were killed and at least 308 were wounded. According to Newsweek, 10 men in inflatable speedboats came ashore at two locations in Colaba, on the coast near Mumbai. They reportedly told local Marathi-speaking fishermen who asked them who they were to "mind their own business" before they split up and headed two different ways. The fishermen's subsequent report to police received little response. The high level of effectiveness of the Mumbai attack, its coverage by the international media and the openness of the coastline to infiltration has provided a warning to other states and national event managers ever since.

The "Lessons Learned" from the Mumbai Attack

In the usual display of slamming stable doors in other places once the horse has bolted, many countries have learned and implemented special measures after the Mumbai attacks. In the United Kingdom, the level of searching and scrutiny of the banks of the Thames in London is one notable example especially during the 2012 Olympics. But the Chinese, who exercise extreme caution to maintain stability and pre-empt insurgent attacks in their coastal metropolitan areas, are a more specific and complex example of where the result of the Mumbai attack has had a major impact.

Chinese Analysts have Responded to the Details and Nuances of the Attacks

Firstly, the terrorists came to Mumbai via a sea route, sailing from Karachi on a Pakistani cargo

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The need for strong coastal surveillance is common to all countries with coastlines. China has a coastline of about eighteen thousand kilometers, and coastal surveillance is of major importance, especially in the light of the Mumbai terrorist attacks.

vessel. They first hijacked an Indian fishing boat and murdered all its crew except for the captain, then proceeded to Mumbai.⁹ They killed the captain as they neared their destination. Coming by sea had several advantages over coming by land, allowing the terrorists to avoid Indian security checkpoints at the frontier or at airports; also, sailing on an Indian vessel enabled them to avoid arousing the suspicion of the Indian coast guard. Second, the terrorists were well trained and highly organized. They seem to have known locations of targets even better than the responding government forces. They were working together as a unit and they coordinated with each other using high-tech equipment. They used hand signals to communicate across loud and crowded spaces. Thirdly, these terrorist attacks were carefully planned. Their targets were carefully chosen – they were all commercial centers with high densities of people. The timing of the attacks, which was during the peak hour at night, was well planned.

Filling the Gap in Coastal Surveillance and Interception

The terrorists reached Mumbai through a sea route, and the gap in India's coastal surveillance was highlighted in media coverage. The importance of coastal surveillance and interception capabilities has been a noted area of vulnerability for many countries. The lack of coordination between the coast guard and the navy enlarged the gap and made the case worse. The need for strong coastal surveillance is common to all countries with coastlines. China has a coastline of about eighteen thousand kilometers, and coastal surveillance is of major importance, especially in the light of the Mumbai terrorist attacks. The need for building a stronger coast guard and better coordination between the Chinese navy and various national coast guard elements predated the Mumbai attacks.

Why Does China Need to be so Concerned?

More than many countries, China places a very high priority on stability, especially in "hot spot areas". But it was the warning by the Iranian President that heightened the level of concern

amongst China's leaders. The warning by the Iranian president stated that the Mumbai terrorist planners might plot an attack on China. This warning drew much Chinese expert attention to the issue of stability in the Uighur/Muslim-dominated Xinjiang, which is proximate to both India and Pakistan. In the view of Li Wei, who thinks the terrorists forces were mainly from within India, because of its long-standing internal religious and social conflict, China should draw the lesson of carefully handling potential conflicts in regions like Xinjiang. Special measures were taken during the Beijing Olympics in 2008 and in 2010 during the 5 month long World Expo in Shanghai, which is a coastal city with a coastline of 512 kilometers and 21,000 square kilometers of sea area.

Chinese Special Coastal Security Measures

According to Sun Kai and Guo Peiqing, training to protect the Shanghai Expo 2010 focused on the prevention of destruction by terrorists of important targets at sea, prevention of potential explosions, and prevention of entanglement with local fishermen in coastal areas. New devices were deployed with the Shanghai coast guard, including anti-explosive devices, interception guns, frogmen, and parachutists from helicopters. For the longer time span of World Expo 2010, coordinated efforts to draw security resources from neighboring municipalities were implemented. New ships were built, especially including high-speed motorboats and patrol ships. The Chinese navy's East Sea Fleet coordinated with the coast guard to form an outer sea-security picket.¹⁰

Stronger, Multilayer "Great Wall" on the Sea

While China looks beyond its coastline to protect its national and regional interests further from the shore, a consequent need arises for the greater surveillance, protection and interception of China's coastal areas which some commentators see as prone to 'inefficiencies'. But China is not alone. While China works to build its special forces to control the littoral areas, other emerging countries with strong defence budgets are looking to upgrade their coastal defences against insurgent attacks.

Submersible Boats in Action and the Future

Mary Dub, Editor

SLEEPING BEAUTY' was the name given to the first submersible vessel, a canoe, because the designer Quentin Crewe was once found asleep in the prototype. The work done by Special Operations Executive (SOE) on the canoe was the forerunner of the submersible vehicles produced today. During the Second World War the futuristic looking canoe-like tube could accommodate one pilot and an additional frogman crouched in the cone. However, it was difficult to control. This submersible vessel was used in 1943 and on other operations later in the war. 60 years later, the works of the General Dynamics Electric Boat Company offer a stark contrast. In 2006 General Dynamics Electric Boat was awarded a \$5.7 million contract to support development of the Underwater Express, an undersea transport capable of controllable speeds up to 100 knots through 'supercavitation'. (Supercavitation involves surrounding an object with a bubble of gas that allows it to travel at high speed). Supported by DARPA (Defense Advanced Research Projects Agency) the Underwater Express Program will help determine the feasibility of supercavitation technology to enable a new class of high-speed underwater craft for future littoral missions that could involve the transport of high-value cargo and/or small units of personnel.

The Tactical Advantage of Stealth for Submarines

The key advantage of all submarines or submersible vehicles is stealth. They deliver surprise attack to an enemy and invulnerability when submerged, if they can operate with a low acoustic signal. For any submarine, silence and low trackability is critical. To address this threat, DARPA is working on the Anti-Submarine Warfare (ASW) Continuous Trail Unmanned Vessel (ACTUV) program. These Unmanned Vessels seek to deliver advanced autonomous operations technology with a goal of full compliance with safe navigation requirements while executing a tactical mission under a sparse remote supervisory control model. ACTUV will

leverage its unique characteristics to employ a novel suite of sensors capable of robustly tracking quiet diesel electric submarines to deliver a game-changing operational capability that puts asymmetric, tactical and economic advantages in the United States' favor.¹¹

DARPA's DASH

Another potentially unmanned submarine program is DARPA's, appropriately named, DASH (Distributed Agile Submarine Hunting). The program confronts the asymmetric underwater threat to legacy ships by diesel-electric submarines. These submarines have been part of a trend toward lower acoustic signature levels, and have grown in lethality. Through the development of advanced standoff sensing from unmanned systems, the new system uses deep ocean sonar nodes operating at significant depths in open ocean areas to achieve large fields of view to detect submarines overhead. Each deep node is the maritime equivalent of a satellite, and is referred to as a subullite. The significant field of view, along with the advantage of low-noise phenomena at extreme depths, will permit a scalable number of collaborative sensor platforms to detect and track submarines over large areas. The research work is highly focused on achieving new detection modalities with sufficient low power, weight, and size, to enable UAV implementations.


UK MOD Commits to New Pending on the Next Generation of Nuclear Submarines

The future of defence spending in the UK looks bleak and the man count in land forces is being reduced. Yet the value of future submarine capability is not ignored. On 29 October 2012, the Defence Secretary, Phillip Hammond, announced an additional £350M worth of funding for the next stage of design work for Successor, the future generation of UK nuclear-armed submarines. The Vanguard class submarines, which carry Britain's nuclear deterrent, will be replaced in 2028 by the new successor. The

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If the Precision Inertial

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new technology will

provide an important

step forward in

silence and therefore

invulnerability for

underwater and

submersible vessels

adding to their utility

and capability.

contract brings work to BAE Systems and a further £38mn to Babcock.

A Key area of Vulnerability for Submarines is the Lack of GPS Type Navigational Systems

The Precision Inertial Navigation Systems (PINS) program initiated by DARPA seeks to use ultra-cold atom interferometers as an alternative to GPS updates. Advances in atomic physics in the past 2 decades have given scientists much better control over the external quantum states of atoms, including deliberate production of matter waves from ultra-cold atoms. This has allowed development of matter wave interferometry techniques to measure forces acting on matter, including high-precision atomic accelerometers and gyroscopes. An inertial navigation system that used this technology would have unprecedented drift rates. It is hoped that the PINS program will demonstrate a high-precision atom interferometer inertial navigation system on an aircraft by 2013, with a total system volume under 20 liters. Since this is an entirely inertial system, it will require no transmissions to or from the platform, thus enabling a jam-proof, non-emanating inertial navigation system with near-GPS accuracies for future military submarines, aircraft, and missiles. If the Precision Inertial Navigation system becomes a reality, this new technology will provide an important step forward in silence and therefore invulnerability for underwater and submersible vessels adding to their utility and capability.

The Importance of Size, Scale and Agility

While DARPA is working on unmanned systems and tracking and navigation devices for small and large submarines, the increasing use of Special Forces in marine and amphibious operations in coastal littoral areas will always leave a place for innovative craft like the submersible vehicle and the small flexible submarine. The nature of warfare is always uncertainty about the nature of the future threat. New technologies and new adaptations of legacy concepts will always have an important place in a market, even a Western European market that appears mired in austerity and cuts. However, with the salience of the global threat of terrorism and insurgency in metropolitan littoral areas, the demand for covert small flexible submersible vehicles will be assured.

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