Littoral Combat Ship
MQ-25A Stingray
MQ-8C Fire Scout
HELIOS
Unmanned Surface Vessels

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Administered by the Program Executive Office for Unmanned and Small Combatants, the Navy’s Littoral Combat Ship (LCS) program provides the fleet with a package of capabilities focused on three primary missions — anti-submarine warfare, surface warfare, and mine countermeasures.

By CDR Scott Larson

The U.S. Navy’s Littoral Combat Ship (LCS) program is bringing an array of new capabilities to the Fleet. The challenge now is finding a balance between crew skills proficiency and real-world application.

By CDR Chris Marvin

Commander’s Corner

RADM Brian Corey
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Leadership Perspective

CAPT Seiko Okano
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Unmanned Focus

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Cover: The MQ-8C Fire Scout unmanned helicopter conducts its first test flight from the Independence-class USS MONTGOMERY (LCS-8) off the coast of California. (U.S. Navy photo)
As 2019 commences, challenges to maintaining and sustaining force readiness in the face of new capabilities in Fleet operations is on the mind of many a U.S. naval commander. With the relatively recent inclusion of littoral combat ships (LCS), directed energy integrated warfare lethality, and unmanned strike weaponry into the Navy's capabilities portfolio, the projection of greater combat power is giving similar rise to the need to manage that power.

Without dispute, the Navy's LCS capability in both trimaran Independence-class and mono-hull Freedom-class formats has been a needed addition to enhance Fleet antisubmarine warfare, surface warfare, and mine countermeasures. In an exclusive to the Winter 2019 issue of Naval Power & Force Projection (NP&FP), CDR Scott Larson, Principal Assistant Program Manager, LCS Fleet Introduction and Sustainment Program Office (PMS 505), PEO Unmanned and Small Combatants, speaks to strengths and challenges facing the Navy's integration and readiness efforts with LCS. In a personal perspective, CDR Chris Marvin, Surface Force Atlantic Staff N8 Directorate, U.S. Fleet Forces Command, gives a perspective on the extensive challenges associated with crewing, maneuvering, and sustaining high-level readiness to perform the missions for which LCS was designed. From launching off-axis missile strikes from a position of stealth or delivering clandestine forces quickly to shore with speed and precision, the asymmetric impact that only LCS brings to U.S. Navy Fleet operations is still yet to be determined.

The Winter issue also looks at the state of Navy unmanned offensive weapons lethality in an exclusive interview with RADM Brian Corey, Program Executive Officer, Unmanned Aviation and Strike Weapons (PEO U&W), with insight into the PEO’s mission to execute full-spectrum warfare systems acquisition and fleet support. PEO U&W’s unmanned aircraft programs incorporate everything from small, hand-launched unmanned air systems (UAS) that can connect to a handheld device and deliver full-motion video to commanders anywhere, anytime. From a sensory perspective, the idea of using laser light to incapacitate enemy systems is no longer a figment of the imagination. In an exclusive interview with CAPT Seiko Okano, Major Program Manager, Above Water Sensors, Program Executive Office Integrated Warfare Systems (PEO IWS 2.0), NP&FP focuses on current directed energy laser technology and how the Navy is using High Energy Laser and Integrated Optical-Dazzler with Surveillance (HELIOS) to detect drones at considerable distance with long-range surveillance.

Rounding out this issue, we shed light on the future of unmanned surface vessels as a critical part of the Navy's Surface Combatant Force. RADM Ronald A. Boxall, Director, Surface Warfare, OPNAV N96, speaks with NP&FP regarding some key priorities within the Navy's Surface Capability Evolution Plan (SCEP) such as enhanced lethality, distribution of forces, human-machine teaming, and integration of effects.

We welcome comments and suggestions. Thank you for your continued readership.
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LCS: A VESSEL OF OPPORTUNITY

The Littoral Combat Ship (LCS) program is a departure from traditional U.S. Navy shipbuilding programs based on its use of innovative acquisition, construction, manning, training and operational concepts. The program, administered by the Program Executive Office for Unmanned and Small Combatants, provides the fleet with a package of capabilities focused on three primary mission areas — anti-submarine warfare, surface warfare and mine countermeasures. LCS consists of two variants, the mono-hull Freedom variant and the trimaran Independence variant, and each ship is dedicated to one of those three missions. Sixteen ships have been delivered to the Fleet, and Sailors are just beginning to understand what the LCS is capable of. Below, CDR Scott Larson, former CO of USS CORONADO (LCS 4), an Independence variant, and CDR Chris Marvin, former CO of the Freedom-variant USS DETROIT (LCS 7), reflect on their respective experiences and explore the art of the possible.

GOING BEYOND THE CONVENTIONAL

The U.S. Navy’s Littoral Combat Ship (LCS) program is bringing an array of new capabilities to the Fleet. The challenge now is finding a balance between crew skills proficiency and real-world application.

By CDR Scott Larson, PAPM, LCS Fleet Introduction and Sustainment Program Office (PMS 505), PEO USC

Littoral Combat Ship (LCS) deployments are helping inform the Navy about the future of this ship class and its potential. As sea control and power projection continue to be the main tenet that the Surface Force delivers to the combatant commander, I firmly contend that both LCS variants have viable and necessary roles to play in serving those objectives.

LCS has already proven its value across multiple warfare areas. We have integrated with Surface Action Groups and Carrier Strike Groups in support of focused operations in the Third and Seventh Fleet areas of responsibility. We have demonstrated our ability to execute over-the-horizon targeting, and LCS is the first ship to integrate an unmanned aerial vehicle (Fire Scout) in order to complete the long-range anti-surface kill chain.

During complex and rigorous testing and evaluation of the Surface Warfare (SUW) Mission Package, we showcased the combat effectiveness and lethality of an SUW-configured LCS when confronted with a “swarm” of high-speed maneuverable surface threats. And we also flexed our self-defense capability in multiple
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successful intercepts of representative anti-ship cruise missile targets (i.e., drones).

Even with these impressive results, much of LCS’s potential remains untapped. Some may hijack that statement to stoke criticism regarding the current state of the program, but I choose to take the opposite view. I see vast and exciting opportunities that should breed optimism concerning the future of LCS and its warfighting capabilities.

Beyond the conventional application of naval surface forces, LCS is uniquely suited to execute a broad range of other missions that often get overlooked or, in some cases, simply marginalized. During the Rim of the Pacific exercises in 2014 and 2016, USS CORONADO (LCS 4) demonstrated successful joint integration with U.S. Marine Corps and Navy Special Operations Force (SOF) elements, acting as an afloat staging base from which to launch simulated raids against pre-selected shore objectives. Our uncommonly shallow draft (approximately 14 feet) significantly enhanced our effectiveness in this role.

On the LCS 2 (Independence) variant, specifically, our highly reconfigurable and expansive Mission Bay affords vast payload possibilities that could potentially support both conventional and SOF ground combat elements. Our massive flight deck also can be leveraged in support of vertical-lift requirements to sustain shore-based forces or, alternatively, to respond to domestic or overseas contingencies, such as humanitarian assistance and disaster relief.

Additionally, the threat of piracy and illicit trafficking continues to pose challenges to the preservation of maritime security and regional stability around the world. To that end, LCS is extremely well-suited to the counter-piracy mission set by virtue of its Maritime Security Module, composed of two 11-meter Rigid Hull Inflatable Boats and a dedicated Visit, Board, Search and Seizure Team. Our organic manned and unmanned helicopters, combined with a capable sensor suite and the ability to achieve speeds in excess of 40 knots, enable us to detect, localize and interdict nefarious actors who seek to exploit — and destabilize — the maritime domain in order to carry out illegitimate activities and disrupt commerce.

**Asset in Coalition Operations**

LCS also is a significant force multiplier with respect to our ability to conduct meaningful and necessary combined operations with foreign maritime partners. LCS critics are intransigent in their collective belief that our lone value proposition resides in the area of theater security cooperation. While theater shaping, or Phase Zero, operations may not “turn heads,” that should not discount its importance toward achieving broader strategic naval objectives. LCS deploys overseas and remains on-station for 18 months, instilling a sense of shared commitment with our allies that reinforces our mutual interests. As a result, we, as a collective Navy, are viewed as legitimate partners, and the bilateral/multilateral exercises of increasing tactical complexity that we conduct with our maritime counterparts not only enhances interoperability but also lays an important foundation that will pay significant dividends if called upon in future contingencies. Many conflicts can be won, or lost, during this phase of operations, and LCS factors prominently in it.

**From Strike Group Protector to Screener**

As we look ahead and forecast future mission sets for LCS, there truly are broad possibilities and applications to consider. While our core manning and C5I (command, control, communications, computers, collaboration and intelligence) systems limit the extent and duration of the integrated support we can provide to a Carrier Strike Group, we could absolutely be employed as a screening force to protect the high-value unit during a heightened-tension, choke-point transit. A combination of short/long-range anti-surface missiles (Long Bow Hellfire and, eventually, the Naval Strike Missile), the Mk 110 57mm anti-surface gun and a tandem of Mk 46 30mm high-speed anti-surface electro-optical infrared point-and-shoot gun mission modules make LCS a veritable force to be reckoned with in the short-range, anti-surface “knife fight.”

An organic, armed MH-60S helicopter only serves to enhance our lethality. Our high-speed capability also can confuse adversary fire-control and targeting efforts and places another valuable — yet often overlooked — arrow in our quiver, and there are some exciting possibilities to explore for LCS application in the realm of electromagnetic maneuver warfare.

For some of this future potential to be realized, there is still some necessary learning that needs to occur. With only three LCS deployments to date that we can draw upon to begin to map out what the future could look like, I contend we are still dealing with a relatively small sample size. At this stage in the program, every day spent operating LCSs at sea is, in fact, a learning opportunity. As Commanding Officer of USS CORONADO, I worked extremely hard to strike the term *routine* from my crew’s vocabulary.

Though every evolution we executed was informed by our collective past experiences, each one carried a unique risk profile due to various complex factors: many first-in-class systems being tested and stressed for the first time under the rigors of deployed operations; a thinly populated “library” of lessons learned from which to draw insights into how certain evolutions would play out; a minimally manned crew whose limits were being continuously tested by the demands of at-sea operations and processes/norms that were still being established and validated; and a high degree of reliance on automated systems, necessitated by our manning construct, that forced us to think differently about risk, particularly safety margins, and how we could safely mitigate it despite the fact that many crew members — especially leadership — had been “raised” on more traditional ships.

In practical terms, this simply meant that everyone had to bring their “A Game” to every single evolution we performed, each and every day. This type of “no passengers” mentality continues to be a defining characteristic of all LCS crews, and it is an effective multiplier that can galvanize the team and propel it to unforeseen heights if properly harnessed.

**Looking Ahead**

The next two years will constitute a watershed moment for the LCS program writ large. Executing additional ship deployments will afford invaluable learning opportunities that will yield critical insights needed to inform the future. Some operational concepts will be further validated, others will be defined, and still others will be abandoned. We will develop a deeper understanding of the operational thresholds created by our unique maintenance and manning models.

The risk equation will be refined and processes will mature. Along the way, new requirements will emerge and new, potentially unforeseen opportunities will present themselves. This is a fundamental reflection of the current status of the LCS program. Critics can manipulate it to serve whatever divisive narrative they elect to purvey, but I would offer that more than enough justification exists to be “bullish“ on LCS, predicated upon the important role these ships can play and the value they provide in the fleet of today and tomorrow.
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In early May 2018, pierside in Port Everglades, Florida, during the annual Fleet Week, I gave the last Distinguished Visitor tour of my command of USS DETROIT (LCS 7). My parting words to the visiting admiral were the same ones I delivered on each of my previous tours to multiple military and civilian leaders: “Sir, the biggest threat to LCS is lack of imagination bounded by the words ‘this is the way we have always done it.’”

Nearly three years prior to that final tour, I had reported to LCS Crew 114 pre-commissioning detachment in Mayport, Florida, as the third person to report to the newly forming crew. The first few months at the pre-commissioning detachment provided plenty of time to read and familiarize myself with the LCS training model and concept of operations. One overarching vision became clear: LCS was not going to be like any of the previous six ships I had served aboard. I had been executive officer on the frigate USS HALYBURTON a couple of years prior to my LCS command. What I found on LCS was a crew of 70 taking care of a ship that has effectively the same surface area and internal volume as the old frigate. The difference on the frigate was that I had 170 sailors to do the work. The individual responsibility and oversight required by every LCS crew member, regardless of rank, cannot be overstated.

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Specialized Readiness Demand

If you are not a motivated self-starter, LCS is not for you. The watch and duty rotation is based around three watch sections. In port, there is potential to get to four sections of duty, but that is largely contingent on the demand for off-ship security watches that generally hold the ship to three sections of in-port duty. For those not familiar with surface Navy lingo, the in-port duty sections dictate the frequency a crew member will spend in a 24-hour duty period on the ship. In the case of three sections, an LCS crew member will be aboard the ship for a 24-hour duty requirement once every three days. The fact is that LCS sailors consistently have higher demands placed on them both mentally and physically than other surface sailors. There were times in preparation for major inspections and
operational situations that pushed the limits of crew capability in finite, defined situations.

At sea, the workload is similar to what is experienced in port. Bridge and combat information center watches on LCS involve half or fewer people on a watch team than what is typically seen across the surface fleet. Each LCS sailor on watch may be performing the tasks associated with multiple watch stations and people on other ships. The ability to maintain focus on critical information while driven to multi-task across numerous functions and warfare areas is the norm. To assist the watch-standers, there is a high degree of automation and information presented to an operator that without substantial training on the ship and in simulators ashore could easily become overwhelming. The minimal manning concept of LCS puts the vessel in every aspect of operation on the cusp of what is possible for a team of individuals and pushes the limit of crew endurance on a daily basis.

The innovative Blue/Gold crewing model not only keeps the ship deployed forward but also provides some important work-life balance for the sailors in light of the daily operational demands associated with routine duty on the LCS. The Blue/Gold concept was one of the points that drove me to set aside some preconceived thoughts on readiness, training and material ownership learned across my career as a surface warfare officer. It is not that these thoughts were wrong, but given the difference presented by LCS, it became obvious a new method of business must be embraced.

One of the biggest challenges of the Blue/Gold model is maintaining a sense of collective ownership between two different crews. Rotational crewing beyond the smaller patrol coastal and mine countermeasures ships, combined with a heavy reliance on simulation training, is new to the Surface Fleet and is in direct contrast to “the way we have always done it.” One of the biggest takeaways for the fleet at large is the success the LCS program has made in high-end simulation training. The LCS Officer of the Deck (OOD) course’s academics, combined with the ship-handling simulation, is one of the best courses of naval instruction that I have ever received.

As systems and the distributed nature of fighting at sea become more advanced, there will be a need to rely more and more on synthetic training environments like those employed by LCS to get the “sets and reps” needed to achieve proficiency while reducing the cost and risk to people and machinery.

**Hull-Specific Variances**

Beyond the manning and training nuances that are germane to each hull form, the mono-hull Freedom LCS variant brings with it an array of capabilities and its own set of challenges. One of the first things any ship driver will notice and appreciate about LCS is the power and responsiveness it has. Unlike other ships, where driving means translating and end-state maneuver through a series of verbal commands to the helmsman, the LCS conning officer has direct control of the throttle and steering. Mastering the concept of the water jet propulsion and vectored thrust can be challenging for
ship-handlers new to LCS. Proficiency is obtained only through large amounts of simulator time combined with practical application on the ship. Once mastered, the close control in docking and undocking maneuvers is a pure joy to execute.

On the counter side, the price to be paid with high maneuverability is lack of directional stability in channel transits and while alongside an oiler. Without the rudder(s) of a conventional screw propulsion system employed on most ships, which also acts like a skeg to prevent yaw, the narrow mono-hull LCS is very responsive to a turn but difficult to maintain on a straight-line heading with its water jet propulsion. Without continuous, very subtle left and right input, heading falls off quickly to one side or the other. Every ship will experience this to some extent, but with steerable water jets, it is easy for a less experienced officer of the deck or conning officer to get into an increasingly large oscillation of overcorrection, to the point that autopilot is used to a much greater extent for heading management than on other U.S. Navy ships.

The speed, maneuverability and combat system of LCS are designed to fight and win against the array of warships employed by the vast majority of the world’s littoral navies. While it can operate in support of more traditional carrier strike groups, expeditionary strike groups and surface action groups, it is crucial to remember that it was not specifically designed with those tasks in mind. As LCS becomes a more numerically large fleet shareholder, fleet commanders and operators must be ready to employ the unique and asymmetric qualities of LCS to the largest extent possible.

The future mine countermeasures mission package will reduce human operators in minefields through the use of unmanned technology. The anti-submarine warfare package will let LCS hunt our adversaries’ quiet diesel-electric submarines in the shallows. The currently fielded surface warfare package provides our Navy distributed presence during peacetime to stabilize regional sea lanes. The imminent addition of the Naval Strike Missile, an over-the-horizon anti-ship cruise missile, will provide LCS with distributed lethality.

### Positioning to Best Perform

LCS is better poised to support our Navy’s inventory to add to the fog of war that drives victory by creating uncertainty and doubt in the command and control networks of the enemy. Whether launching off axis missile strikes from a position of stealth or delivering clandestine forces quickly to shore with speed and precision, these are all missions that LCS can do well. The asymmetric impact that only LCS brings by risking a much smaller force while delivering a high-end punch cannot be overlooked.

Coming full circle, the warfighting tactics supported by an imagination for the art of the possible is what will define LCS. If done correctly and with conviction, and shaped by a collective of informed naval warriors willing to redefine conventional tactics, LCS will shape the future of the world’s naval battlespace.
RADM Brian Corey recently spoke with NP&FP regarding the PEO’s mission to execute full-spectrum warfare systems acquisition and fleet support. PEO U&W’s unmanned aircraft programs incorporate everything from small, hand-launched unmanned aircraft system (UAS) that can connect to a handheld device to deliver full-motion video to something as complex as the MQ-4C Triton, a Group 5 system with a 131-foot wingspan that can operate at 50,000 feet. Numerous UAS programs, including the MQ-8B Fire Scout unmanned helicopter and the RQ-21A Blackjack, have been fielded, with the recently awarded first carrier-based UAS, MQ-25 Stingray, joining the Fleet.

NP&FP: Now that the unmanned refueling aircraft MQ-25A Stingray is under contract, what are some challenges in bringing the Stingray to initial operating capability?

RADM Corey: Acquiring any new system is complex and challenging. With the MQ-25 we are standing up an entirely new capability for the Fleet within a demanding and dynamic environment. This program has many interdependent pieces, including modifications to the carrier, adapting to aircraft carrier (CVN) schedules for installation and testing, and integrating the air vehicle with the required networks and control systems. And we are doing all of this at an accelerated pace, so we can deliver this critical capability to the Fleet as soon as possible.

NP&FP: What operational benefits and advantages will the MQ-25A bring to the fleet and air wing? Are there any particular challenges with using it aboard carriers?
RADM Corey: When operational, MQ-25 will improve the performance, efficiency, and safety of the carrier air wing and provide longer range and greater persistence tanking capability to execute missions that otherwise could not be performed.

Integrating the MQ-25 with the carrier air wing (CVW) is a significant undertaking. This will be the first operational unmanned aircraft to be integrated into the carrier environment. There are many steps that we must achieve to safely and successfully integrate any new technology into this complex environment. For example, we will be installing and integrating mission control spaces and control and connectivity systems on the CVN, training up the community such as air vehicle operators and maintainers, all to support testing and eventual operational use of the MQ-25.

NP&FP: Regarding the MQ-8C Fire Scout, in what specific ways is it expected to be better than the smaller variant, the MQ-8B?

RADM Corey: The MQ-8C is a larger air vehicle than the MQ-8B, offering increased payload capacity and increased endurance. With twice the payload and nearly three times the endurance, the MQ-8C will provide increased situational awareness and targeting information to the ship. The MQ-8C will also be equipped with an advanced surface search radar with a range of digital modes to include Synthetic Aperture (SAR) and Inverse Synthetic Aperture (ISAR) imaging modes. Additionally, the larger payload capacity of the MQ-8C will allow for the addition of networking and communications payloads that the smaller MQ-8B cannot accommodate.

NP&FP: Are there any significant challenges involved in using the MQ-8C aboard a littoral combat ship (LCS)? In what ways does the Navy hope the MQ-8C will increase the lethality of the LCS fleet?

RADM Corey: The fleet has successfully deployed the MQ-8B Fire Scout on LCS and is using the same deployment model for MQ-8C. The increased airframe reliability should make shipboard utilization easier since there will be fewer demands on the aviation detachment maintenance technicians. The greater endurance of the MQ-8C will also allow the ship greater freedom of maneuver since it will need fewer launch and recovery evolutions in a given day.

NP&FP: Are there any plans for using the MQ-8C in conjunction with manned aircraft? If so, what are its capabilities in manned-unmanned teaming expected to be?

RADM Corey: By design, UAS complement the capabilities of our manned aircraft. Composite detachments take advantage of an unmanned aircraft’s long endurance, at the same time leveraging resources from manned squadrons to increase the level of surveillance while reducing the footprint of deployed Naval personnel. The Navy has been using a unique deployment mode for the MQ-8 that naturally enables manned and unmanned teaming. The same aviation detachment maintains and operates an MH-60S manned helicopter and the MQ-8 Fire Scout.

NP&FP: In general, what are the greatest UAV challenges the Navy is currently facing?

RADM Corey: Just a few years ago I would be focusing on the lack of the acceptance of the potential of unmanned from both technical and cultural perspectives. Today, the pendulum has swung in the opposite direction – everyone wants an unmanned capability, and we find ourselves working to bound expectations of what is actually technically achievable today. Much of the challenge today – which we see as an opportunity – is how to leverage machine learning to advance the capabilities of both today’s highly automated and future autonomous unmanned systems. From my perspective, investing in and pursuing the associated technologies will truly make unmanned systems an even greater force multiplier across the entire spectrum of naval warfighting capabilities.

NP&FP: Any closing thoughts?

RADM Corey: The Navy and Marine Corps are increasingly using UAS for a variety of missions. Our future goal is to have every individual on the ground using UAS as organic assets and Naval ships will employ one or more unmanned systems to get the full picture of the battlespace. Integration of these systems will enhance the full range of Naval operations by allowing commanders to rapidly employ emergent, disruptive and technologically superior capabilities.
It’s no secret that directed energy weapons—lasers—offer significant advantages. They cost about $1 per shot to fire, an incredibly cost-effective way to neutralize threats from unmanned aerial vehicles, which are also relatively inexpensive to manufacture. Since one of the major challenges in any combat situation involving missile threats is the cost exchange ratio—the cost of the incoming projectile versus the cost of the interceptor—the very low cost per laser shot is quite an advantage indeed.

That’s where the High Energy Laser and Integrated Optical-Dazzler with Surveillance (HELIOS) system comes in. It can detect drones at considerable distance with its long-range surveillance capability, disable them temporarily, and focus an offensive beam against both air and surface threats, improving situational awareness and defense at sea. It’s a first for U.S. Navy destroyers.

NP&FP: Please explain the High Energy Laser and Integrated Optical-Dazzler with Surveillance (HELIOS) system.

CAPT Okano: HELIOS is a laser weapon designed to augment capabilities of the Flight IIA Arleigh Burke-class destroyers. The weapon’s primary mission is to defend the ship against a variety of air and surface threats and provide a nondestructive dazzling capability against unmanned aerial vehicles (UAVs).

NP&FP: Could you provide an overview of the purpose, goals and benefits of HELIOS?

CAPT Okano: The system combines three key capabilities: a long-range surveillance capability used to identify threats; a laser dazzler that temporarily incapacitates unmanned aerial systems; and a high-energy laser for airborne threats and small boats.
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NP&FP: What are the challenges of integrating laser systems (HELIOS in particular) with other systems on vessels?

CAPT Okano: Integrating any new weapon into the combat system and the existing physical infrastructure of a ship is always a challenge, but one that is familiar to the Navy’s engineering community. The HELIOS team is applying proven AEGIS pedigree for systems engineering, ship integration, and testing to ensure program success.

NP&FP: Are there any limitations to previous or current directed energy weapons (DEW) onboard vessels? How will HELIOS be unique and better than those weapons?

CAPT Okano: HELIOS builds on the previously deployed Laser Weapon System (LaWS) experience by fully integrating the laser into the combat system of a combatant vessel and by providing additional capabilities enabled by a higher-energy laser and an integrated optical dazzler.

HELIOS also builds on the knowledge and experiences concurrently gained from the ONR-funded Solid State Laser Technology Maturation (SSL-TM) program, where the primary goal is to mature the basic high-energy laser and beam director technologies and their ability to operate in a maritime environment.

NP&FP: What are the advantages of DEW over non-laser weapons, such as guns and missiles? Will laser weapons be a game-changer with respect to our warfighting capability against various threats?

CAPT Okano: Laser weapons provide unique capabilities that complement kinetic weapons, including:

- the ability to counter asymmetric threats with deep magazines, limited only by power and cooling, and advantageous target-weapon pairing cost
- the ability to scale effect for escalation of force with precision, with reduced collateral damage and greater scalability than kinetic weapons alone
- instant and precise combat identification and battle damage assessment—with optics capability that enables instant visual feedback on weapon effectiveness at range—and positive hostile identification and BDA as a force multiplier.

NP&FP: Are there any particular threats against which DEW are more effective than other types of weapons?

CAPT Okano: Laser weapons are particularly useful against targets that require precision engagement. In addition, the magazine depth afforded to weapons powered by energy are useful against the proliferation of low-cost asymmetric threats. The ability to scale effects from optical dazzling to physical damage or destruction is another feature that is not normally possible with kinetic weapons.
Naval Power & Force Projection (NP&FP) recently spoke with RADM Ronald A. Boxall, Director, Surface Warfare, OPNAV N96, about the future of unmanned surface vessels in the Surface Combatant Force.

NP&FP: We’ve been watching the slow march of progress in unmanned surface vessels through the Littoral Combat Ship Mine Warfare Mission Module development, and we’re interested in what you’d like us to know about the future of unmanned surface vessels in the surface combatant force.

RADM Boxall: To describe where we’re headed with unmanned surface vessels, it’s important to understand their context in the Future Surface Combatant Force.

RADM Ronald A. Boxall
Director, Surface Warfare
OPNAV N96

In the early to mid-2030s, the Surface Combatant Forces of the United States Navy will begin a significant transition. The Ticonderoga (CG 47)-class cruisers, Arleigh Burke (DDG 51)-class destroyers, and early Freedom-class and Independence-class littoral combat ships (LCS) will begin to retire. Additionally, a return to great power competition will be a major capability and capacity driver for the Surface Combatant Force.

Fortunately, where there are challenges, there are also opportunities. Recently, the Navy commissioned two Capability Based Assessments (CBAs) to kick off the requirements generation process for the Surface Warfare platforms and systems needed to fill the gaps as legacy platforms reach the end of their projected service lives.

The result of these studies pointed to four overarching trends that must be addressed in building the Surface Combatant Force of the future, specifically:

1. **Enhanced Lethality**
   - Surface Combatant Forces must maintain the capability to rapidly disable and destroy adversaries via coordinated use of all elements of surface combatant power.
2. **Distribution of Forces**
   - Achieve and maintain the capability and capacity to distribute combat capability throughout the battlespace.

3. **Human-Machine Teaming**
   - Increased use of unmanned systems to extend the range, persistence, effectiveness, and survivability of Fleet sensors, fires, and command and control.
   - Cross-domain automation of platform maneuver, sensor management, target prioritization, and weapons pairing.

4. **Integration of Effects**
   - Increased networking of combat management systems, sensors, weapons, electromagnetic maneuver, and command and control across all domains.

In order to deliver these capabilities, the Surface Combatant Force developed the Surface Capability Evolution Plan (SCEP). The SCEP is a tool defining platforms and systems required to optimally align the required capability to the appropriate platform. The SCEP specifically calls for the development of a force consisting of:

- Large Surface Combatants (LSC)
- Small Surface Combatants (SSC)
- Large Unmanned Systems (LUSV)
- Medium Unmanned Systems (MUSV)
- Integrated Combat Management System (ICMS)

All of our analysis suggests that the unmanned system components of the Future Surface Combatant Force will be significant contributors to executing the dirty, dangerous, and routine missions associated with Surface Warfare — missions unmanned systems have historically proven effective in executing. Unmanned systems must be capable of providing cost-effective, persistent, cross-domain, autonomous and semi-autonomous solutions that allow for the disaggregation of sensors, fires, and command and control nodes.
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<tr>
<th>Event Title</th>
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<td>Tactical Wheeled Vehicles Conference</td>
<td>February 3-5</td>
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<tr>
<td>30th Annual SO/LIC Symposium &amp; Exhibition</td>
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<tr>
<td>Robotics Conference &amp; Exhibition</td>
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<td>34th Annual Test &amp; Evaluation Conference</td>
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<td>National Health Symposium</td>
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<td>62nd Annual Fuze Conference</td>
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<tr>
<td>Undersea Warfare Technology Conference</td>
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<td>Municions Executive Summit</td>
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Unmanned surface vessels (USVs) of the Future Surface Combatant Force will capitalize on the investments in USV autonomy and control that have been developed in support of the Littoral Combat Ship Mine Warfare Mission Module as well as the DARPA and Office of Naval Research Sea Hunter Unmanned Surface Vessel program.

While much of the development of USVs to date has focused on relatively small (approximately 11 meters) vessels, command and control, autonomy, navigation, and reliability development will be scaled up to allow the networking and control of both Large Unmanned Surface Vessels (LUSVs) and Medium Unmanned Surface Vessels (MUSVs).

Outfitted with the appropriate level of autonomy, these LUSVs and MUSVs will no longer rely on transport to the operating area in larger Navy ships. These USVs will be pier-launched and capable of deploying forward with fleet formations when required. As autonomy levels continue to increase, USVs will evolve the capability to distribute fires and sensing in support of a disaggregated force that will complicate an adversary’s ability to deny Surface Combatant capability and provide Fleet Commanders additional options in the application of offensive firepower.

NP&FP: You’ve mentioned increased levels of autonomy. As this technology brings increased capability, how does OPNAV N96 see the movement toward greater unmanned systems autonomy being balanced against maintaining operator influence?

RADM Boxall: While we’re very excited about the potential for LUSVs and MUSVs to deliver distributed capability in support of DMO, we are also being realistic about the ability of autonomous systems to act independently, with reduced human oversight.

This oversight may manifest itself as human-in-the-loop, in the case of navigation, where an operator located on a ship or in a Maritime Operations Center (MOC) provides a limited supervisory function as it executes the directed transit or navigation plan. On the other hand, a human-in-the-loop construct is probably more appropriate for the deliberate decision making associated with employing offensive weapon systems.

What we’d really like to be able to do in the first block of large USVs is to automate the navigation, mechanical, electrical, and auxiliary functions of the ship with a very high degree of reliability and redundancy. The mission systems functions of these new USVs will likely be more closely managed and supervised by a human operator to ensure these capabilities are applied in accordance with fleet guidance and policies. There may be a point in the future where the Integrated Combat System is robust enough to allow more mission system autonomy, but we’re not trying to make that sort of technological leap right out of the gate. We’re taking a measured approach to autonomy as we grow the Fleet’s trust and experience in operating USVs.

This crawl, walk, run approach to autonomy should allow us to build a little, test a little, and learn a lot as we introduce these capabilities into the Surface Combatant Force.

NP&FP: How does N96 see the coordination of surface, subsurface, and airborne unmanned vehicles as critical for future mission support?

RADM Boxall: In today’s competitive environment, we are required to coordinate across all domains. Manned and unmanned platforms will have to coordinate across the battlespace for efficient delivery of combat power. The decisions we are making in unmanned systems are targeting the ability to truly take advantage of the distributed, nodal construct to bring the correct mix of capability and capacity in fires, sensing, networks, communications, and command and control. In this construct, we must work across all the warfare domains to maximize the benefit of unmanned systems.

The ability of Future Surface Combatant Force LUSVs and MUSVs to distribute fires and sensing throughout the battlespace will be an important contribution to the Fleet’s ability to effectively distribute forces and deliver maximum warfighting effects.

NP&FP: Are there any other goals or initiatives regarding the plans for Future Surface Combatant Force LUSVs and MUSVs going forward?

RADM Boxall: We’re positioning to move quickly with our industry partners to produce the initial prototype LUSVs and MUSVs. In fact, we’ll be releasing requests for information to industry very soon to help us think through how we make USV’s more capable, reliable, and able to integrate with current and future platforms and systems. These vessels will allow the required tactics, techniques, and procedure development as we transition larger unmanned vessels to the Fleet. In support of these development efforts, we’re working to establish the right organizational construct that will allow direct operator input to the unmanned vessel capabilities the Surface Force is delivering. We’re entering an exciting time in Surface Warfare where LUSV and MUSV development and fielding will deliver the Combatant and Fleet commander greater options in distributing capabilities across the battlespace.
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