1 INTRODUCTION

The *United States Coast Guard Shipyard Optimization Plan* ("Plan") presents a long-term strategy for the United States Coast Guard Yard ("Yard") to optimize industrial production and project support facilities for its future mission.

1.1 Background

Throughout its 122-year history, the Yard has adapted to the changing needs of the United States Coast Guard (USCG) Fleet ("Fleet"). The Yard has evolved from shipbuilding and ship repair on wood- and steel-hulled ships in the early 20th Century to its present mission supporting USCG's fleet of patrol boats, cutters, tenders, and tugs.

The Yard is capable of a wide range of ship maintenance and construction services but has focused on services where it enjoys competitive advantages (e.g., mid-life availabilities, major maintenance availabilities (MMA), service life extension projects (SLEP), RDAPs, etc.).

The Yard is one of the country's five public shipyards[1]. It was established in 1899 and is situated on a 113-acre waterfront site outside Baltimore, Maryland on Curtis Creek, a tidal river on the upper reaches of Chesapeake Bay (Figure 1-1).

The Yard is a critical maintenance asset supporting fleet operations. It operates as one of seven shared services divisions within USCG Surface Forces Logistics Center (SFLC) and provides engineering, maintenance, supply, and technical information services. Additionally, the Yard's capability serves as strategic asset that can be called upon to best support the National Fleet as the country requires.

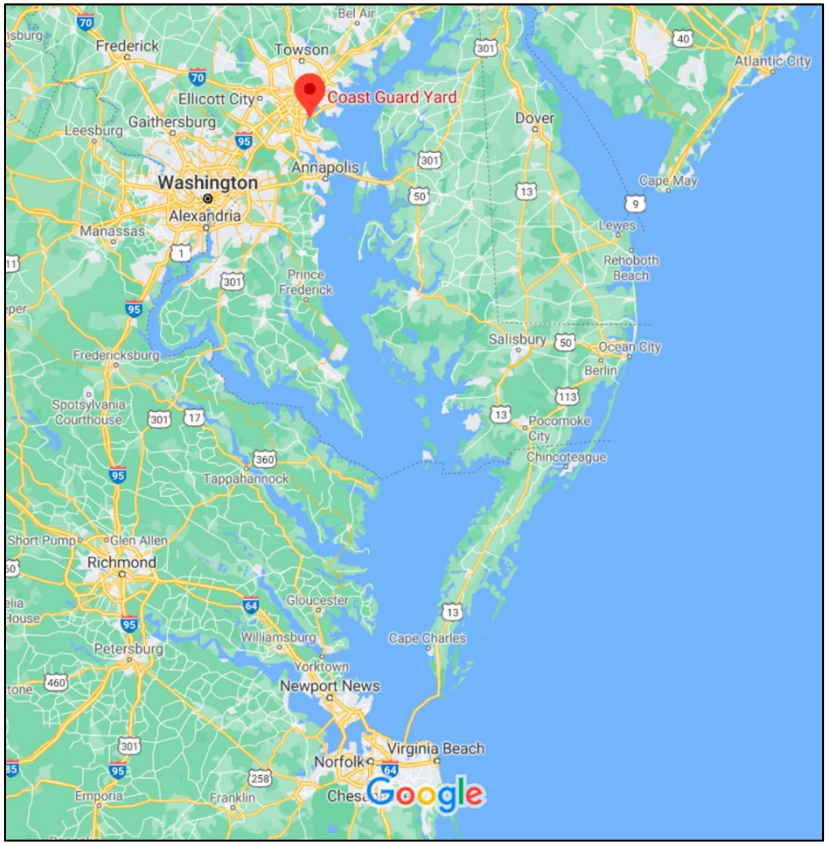

Figure 1-1: Coast Guard Yard and Chesapeake Bay

[1] The other four are US Navy shipyards.

Coast Guard Yard

1.2 Organizational Structure

The Yard's Commanding Officer (CO) is directly supported by an Industrial Manager (IM) and Executive Officer (XO).

The IM oversees direct project support functions, including:

- **Industrial Production:** Production Manager (PM), Dry Dock, Port Operations, Structural Group (X10), Mechanical Group (X20), Electro Group (X30), Services Group (X40)
- **Project Management:** asset managers, ship superintendents, project coordinators that manage all work performed at the Yard or executed by Yard personnel throughout the world.
- **Planning and Estimating:** handles production controls, projects schedulers, support contracts.
- **Engineering and Business:** Hull Branch, Mechanical Engineering Branch, Electrical Engineering Branch

The PM oversees the Yard's four industrial production groups, as well as dry docking and port operation services. Table 1-1 identifies the production shops related to the four groups.

Table 1-1: Production Shops

Group	Ref	Shops
X10-Structural	X11	Shipfitting
	X12	Sheetmetal
	X13	Welders
	X41	Boatjoiners/Woodworking
X20-Mechanical	X21	Pipe
	X22	Inside Machine
	X23	Outside Machine
	X25	Engine
X30-Electro	X31	Electrical
	X33	Ordnance
X40-Services	X24	Garage
	X42	Paint
	X43	Material Handling/Riggers
	X46	Central Tool Room

The XO oversees administrative functions including: Health, Safety and Work-Life Service Center; Public Affairs; Military Support; Quality, Safety, Training; Financial Operations; and Facilities Engineering, among others.

The Fleet maintains on-site representatives through its In-Service Vessel Sustainment (ISVS) Project Resident Office (PRO) Baltimore. PRO Baltimore monitors budget, schedule, and contract performance to ensure the successful execution of maintenance availabilities. PRO Baltimore representatives coordinate closely with the project management and production representatives throughout the planning and execution of availabilities.

1.3 Strategic Issues

Two reference documents provided important context for the study: the *2019-2029 Yard Facilities Master Plan, U.S. Coast Guard Yard Curtis Bay* (2018) and *The Ten-Year Strategy of the United States Coast Guard Yard* (2019).

These documents identified strategic issues that will influence the future mission and relevance of the Yard, including:

- Vulnerabilities from aging facilities and infrastructure
- Changing marketplace for ship maintenance services
- Transition of the Fleet to new classes of ships
- Need for USCG to maintain organic maintenance capabilities
- Need for Yard to recapitalize its facilities and infrastructure to ensure its relevance to the Fleet.

The 2019-2029 Yard Facilities Master Plan addressed short-term facility priorities for the Yard. The current Shipyard Optimization Plan outlines long-term facility and optimization priorities and complements the earlier Facilities Master Plan.

1.3.1 Next Generation USCG Fleet

The Coast Guard is adapting its infrastructure capabilities for future ship classes.

These future classes of ships are expected to be larger and more technologically complex. The Yard will need to upgrade its waterfront infrastructure and productive capabilities to support these more capable assets. As summarized in Table 1-2, new classes of ships joining the fleet include the *Sentinel-Class* Fast Response Cutter (FRC), *Heritage-Class* Offshore Patrol Cutter (OPC), and *Legend-Class* National Security Cutter (NSC).

Future Classes of USCG Cutters (NSC, OPC, FRC)

Table 1-2: Future USCG Cutter Fleet

Type	Existing Ship Class	Future Ship Class
Coastal Patrol	WPB Island-Class (110 ft, 168 tons)	FRC Sentinel-Class (154 ft, 353 tons)
Medium Range	WMEC Reliance-/Famous-Class (210 ft/270 ft, 1127/1800 tons)	OPC Heritage-Class (360 ft, 4520 tons)
Long Range	WHEC Hamilton-Class (378 ft, 3250 tons)	NSC Legend-Class (418 ft, 4500 tons)

1.3.2 USCG Organic Maintenance Capabilities

The Yard currently performs 15 percent of the Fleet's depot-level maintenance. The other 85 percent is performed by private, commercial shipyards. Whereas the U.S. Navy is required by law to perform a minimum of 50 percent of its depot-level maintenance in its public shipyards, USCG does not have similar requirements to perform maintenance on its vessels at the Yard. The Yard must actively compete with commercial shipyards for its share of USCG work. This provides USCG the flexibility to assign highly technical or fiscally risky maintenance projects to the Yard or send a cutter for emergent repairs following a casualty incident.

USCG depot-level ship maintenance is impacted by, and vulnerable to, changes in commercial shipyard repair capacity. There has been a steady decline in domestic commercial repair shipyard capacity. This trend will be

further exacerbated by the Fleet's transition to its new ship classes. This has been borne out in recent years with solicitations for contracted availabilities receiving either a single bid or no bids due to lack of available capacity in commercial shipyards.

There is a projected 40 percent decline in available domestic commercial drydocking capacity when USCG transitions from its existing cutter fleet to the future ship classes[2]. This represents a significant cost and schedule risk to the Fleet. For 122 years USCG has maintained in-house, or "organic," capabilities to service its own fleet because of the fiscal and operational availability benefits.

Recapitalizing the Yard's aging facilities and infrastructure is critical to its ability to remain competitive and maintain the required capabilities to support USCG's future fleet.

1.3.3 Docking Capacity for the Future Fleet

The T. Roland Lewis Shiplift system is a core asset of the Yard. It includes two major components with a 3,350-ton capacity lifting platform capable of lifting all classes of existing USCG cutters except the NSC, OPC, or medium and heavy ice breakers and a four-ship capacity rail-based land transfer system.

The Yard currently performs depot-level availabilities on the Fleet's existing medium endurance cutters (MEC). With the ongoing transition of the current MEC fleet to the OPC and the completed transition of the HEC fleet to NSC, the Yard will be unable to continue servicing the OPC and NSC fleets due to limitations of its existing lifting platform to support new ship classes. Addressing this potential lost capability is a priority for the Coast Guard and was the subject of a planning study in 2010, *Planning Efforts for Ship Handling Facilities at Coast Guard YARD, Baltimore, Maryland*[3].

The Yard is also the preferred location for any mid-life or service extension project to the NSC fleet. This was demonstrated in the 210 ft Major Maintenance Availability cutter contracts that were performed on the commercial market where cost spiraled with growth work. This was also recently demonstrated with the U.S. Navy 108ft Yard Patrol craft Service Life Extension Project (SLEP).

1.3.4 Recapitalizing Piers and Waterfront Infrastructure

Existing piers and waterfront infrastructure are aging and will require structural and utility upgrades to support future ship classes. As documented in the *2019-2029 Yard Facilities Master Plan*, almost all of the Yard's infrastructure was installed between 1939 and 1943 and has exceeded its expected service life. Existing waterfront infrastructure consists of over 10,000 wooden piles that were not designed for the service loads of the new generation of cutters and materials. These requirements are being evaluated by a series of separate engineering studies.

1.3.5 Expanding Recurring Depot Availability Program

The Yard successfully established an RDAP program for the Atlantic Area fleet of 47 coastal patrol boat. The RDAP program is based on short-duration docking availabilities (2-3 months) scheduled at fixed intervals (e.g., every 4 years). This program reduces the overall time in which ships are removed from operational availability by reducing the need for longer duration docking availabilities throughout a ship's service life. This "ounce of prevention" strategy maintains a higher overall material condition.

The RDAP program for patrol boats has been operating out of temporary facilities near Pier 1. Temporary facilities create less than ideal working conditions, are inefficient for staging work, increase environmental risks, and are not ideal long-term facility solutions. Permanent facilities increase the productivity and efficiency of the Yard, directly translating to increased operational availability of ships to the Fleet. The Coast Guard is now expanding the RDAP program as the preferred maintenance strategy for the Atlantic Area FRC fleet.

[2] "CG Yard Facility Analysis & Planning, Large Cutter Shiphandling Facilities at the Coast Guard Yard" Brief, 26 Jan 2021, SLFC/CGY.

[3] The preferred alternative (Scenario C, Alternative B) was a new OPC-capable Shiplift with a lifting platform and finger piers east of the existing Shiplift and a new dual-rail land transfer system on the existing Shipways. The cost for this project was identified in the 2010 study and is included in this Optimization Study (with additional escalation to FY28).

1.4 Existing Projects

The Yard is proposing several projects to address immediate mission priorities. These include facilities to support FRC RDAP work, an expansion of the Shiplift transfer system, and developing Major Cutter Shiphandling Capability (MCSC)(see Figure 1-2).

1.4.1 T. Roland Lewis Shiplift Expansion

The T Roland Lewis Shiplift land transfer system will be expanded with a third set of rails. This will increase the capacity of the Shiplift from four to five cutters. The $26 million project is funded and under construction. Completion of the project is scheduled for 2022.

While the project increases capacity for the existing Shiplift, it does not address the Yard's need to dock an OPC or NSC.

1.4.2 FRC RDAP

A new $22.5 million, waterfront haul out facility with a 24,650 sf FRC RDAP maintenance building has been funded, is currently in design, and scheduled for completion in 2024.

The proposed facility will house two FRC bays and will be situated immediately to the west of Building 78. The project includes new finger piers between the end of berth W3 and Pier 1 to accommodate an FRC-capable marine travel lift. A new structurally reinforced travel-way will connect the finger piers to the new facility. The project will demolish two X12 storage buildings and a portion of the X42 paint complex.

This project addresses the need for the Yard to provide permanent facilities to support depot-level work on patrol cutters and other small boats.

1.4.3 Major Cutter Shiphandling Capability

The Yard is pursuing approval of a $114 million project to acquire a Major Cutter capable floating dry dock and make related structural and utility upgrades to Piers 1 and 3. The dry dock will be located at Pier 3 and will include dredging the basin along Pier 3 and the channel into the Yard.

The Yard's funding application is scheduled for 2021, with acquisition and completion of shore improvements expected sometime after 2025.

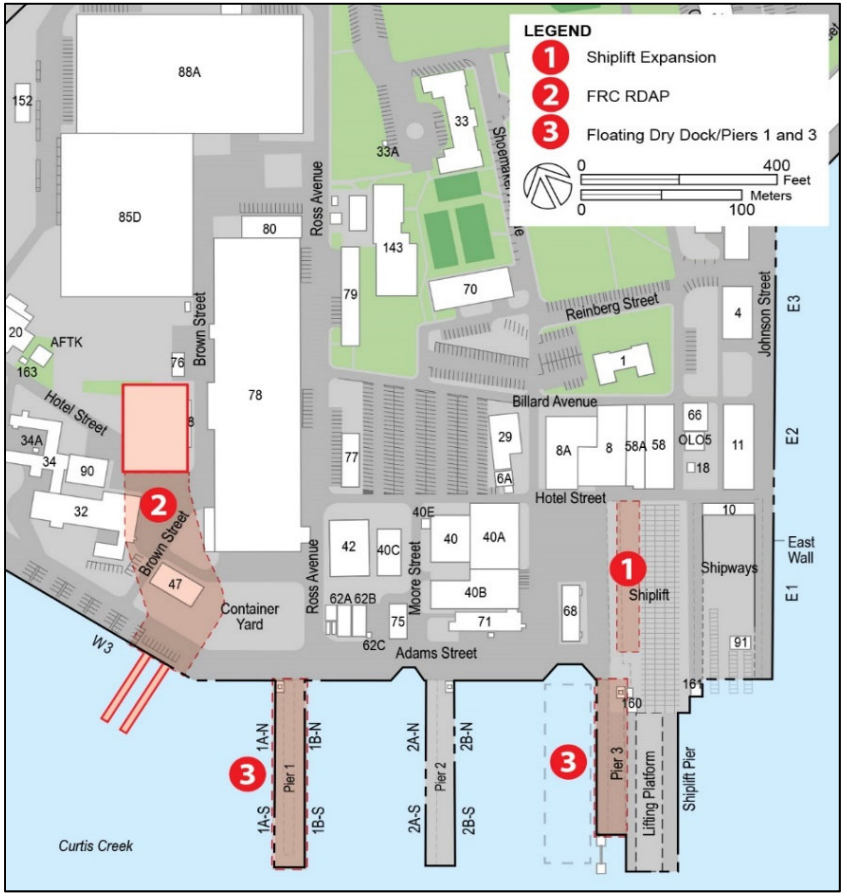

Figure 1-2: Existing Projects

This project will address the Yard's need to dock a major cutter. However, the Yard will be limited to one major cutter docking at any given time and would not be able to support multiple, concurrent dockings needed to support mid-life availabilities or service life extension projects and regular quadrennial dry dockings.

The Yard is continuing to evaluate long-term solutions to support multiple, concurrent major cutters.

1.5 Planning Process

The study team worked closely with the Facilities Engineering Department and Yard Leadership to assess and document existing conditions and process flows at the Yard, clarify facility priorities and operational requirements, and ultimately develop concepts to optimize facilities.

1.5.1 Site Observations

Initial observations were conducted virtually with the aid of publicly sourced aerial imagery and detailed site photographs provided by the Yard facilities engineer. These site photographs included interior photos of major production shop facilities and exterior storage and laydown areas.

Online review sessions were conducted with production shop, project management, and ship superintendent representatives. These sessions focused on understanding and documenting the existing configuration of facilities and project-related process flows.

Following the online sessions, the study team conducted a two-week site visit for working meetings with Yard senior leadership, visits to existing production shop and work sites, and to collect additional facility and process flow insights from shop and project support managers.

On-site meetings with leadership also were used to clarify study themes and priorities, document facility requirements, identify process flow deficiencies, and review preliminary planning concepts.

Production and project support facilities that were poorly situated, poorly configured, and/or substantially undersized were identified. Although the study did not include a systematic condition-based assessment of facilities, a cursory visual inspection revealed that many of the facilities are well beyond their useful service life. The Yard advised the study team which buildings were in poor condition and had previously been identified for demolition. Many of the worst conditioned or most inefficient buildings are located on the highest priority redevelopment sites. This doubles the impact of optimization efforts: first by replacing small, deteriorated buildings with modern, purpose-built facilities and second, by optimizing the location of production functions and resources to support efficient process flows.

1.5.2 Facility Requirements

Facility requirements were prepared for production shops and project support functions. Requirements were identified by the following use categories: shops, staging, storage, shop support (break rooms, meeting rooms, locker rooms), offices, lab, training, and exterior laydown.

Requirements were established to meet current and future mission needs based on existing permanent facilities and adjusted with input from shop representatives and Yard leadership. These requirements also considered temporary facilities used by shops, particularly for storage. Office space requirements were based on staff counts and a U.S. Department of Defense (DoD) gross unit area factor for administrative office space[4].

The facility requirements are summarized in Section 3.5. Facility requirements for production shops can be addressed through large, open-bay, flexible workspaces, typical of modern private-sector, industrial production facilities. These facilities and associated utility and support infrastructure can be configured to transform over time to meet evolving needs of the future Yard.

1.5.3 Process Flow Analysis

The analysis revealed two major patterns of movement of people and materials associated with production processes at the Yard. Materials tend to move in similar patterns around the Yard and are captured in the transportation department logs. People tend to follow a "rhythm of the day" and while there are day-to day variations, the average day for staff who deploy to work onboard ships or work predominately in shop areas remains generally consistent.

[4] UFC 2-000-05N Facility Planning Criteria for Navy/Marine Corps Shore Installations, date varies.

Representative process flows were evaluated for production work performed on ships ("shipboard-oriented") and performed largely in shops ("shop-oriented"). The process flows developed for this study represent general movement of personnel, materials, and/or components required to currently support the activity.

For shipboard work, the process flows document shop personnel from the start of the day, to muster and staging areas, and ultimately onto ships, and then in reverse as the workday ended. The movement and staging of materials and components, temporary services, and containment systems to support shipboard work were also identified.

For shop-oriented work, the process flows document components from their initial removal, disassembly, staging, and eventual transfer to shops where they are refurbished and reassembled, and then reinstalled on the ship.

The most significant process flow benefits differ depending on the orientation of work. For shop-oriented work, optimizing the flow of components and materials between shops and within shops returns the most benefits. For shipboard-oriented, reducing distances traveled and time lost from the movement from personnel and resources over the course of a day yields the most benefits.

1.5.4 Gaps and Opportunities

Through interviews and facilities tours with Yard personnel, facilities-related configuration gaps that diminish the efficiency of existing process flows are identified and include yard-wide and shop-level process flows.

Yard-wide gaps are due to the scattered location of shops, indirect travel routes between shops, and the distance between waterfront work sites and key production shops and support areas.

Shop-level gaps are due to a lack of space, poor configuration of workspaces, inadequate access, and lack of staging areas in shops. Extensive workarounds are regularly employed by staff to address these gaps.

Areas of opportunities to address Yard-wide gaps include undeveloped and underdeveloped sites in in the industrial core and near waterfront work sites, as well as potential reconfiguration of roads.

Areas of opportunities to address shop-level gaps include developing purpose-built facilities that are optimally sized and configured to support a shop's process flows or repurposing existing facilities for uses more suitable for their respective characteristics.

1.5.5 Planning Concepts

Based on the gaps and opportunities, alternative site concepts were presented to the Yard during the site visit. The concepts were further refined based on leadership feedback and ultimately developed into the Recommended Optimization Plan presented in Chapter 4.

1.5.6 Process Flow Improvements

Existing representative process flows were compared with comparable process flows based on the Recommended Optimization Plan. The resulting difference served as the basis for documenting process flow improvements, namely reduced distance traveled and improved logistics with regards to the movement of components and supporting resources.