

Aerospace & Defense Practice

Redeveloping legacy sites to boost global maritime industry capacity

How can the global commercial and defense maritime industry meet the recent spike in demand while saving time and costs? With a strategic process to redevelop their existing legacy sites and assets.

This article is a collaborative effort by Brooke Weddle, Nick Mellors, and Ryan Brukardt, with Andy Voelker, Benjamin Plum, and Sean Cassady, representing a private sector perspective from McKinsey's Aerospace & Defense Practice. Our A&D Practice focuses on helping executives improve outcomes for companies in the Aerospace & Defense sector.



The global commercial and defense maritime industry is on the cusp of a new era amid rising demand. With 20 percent growth forecast by 2030, the industry has an opportunity to refocus on shipbuilders, suppliers, and repair yards in the United States and Europe.¹ But decades of underinvestment, long-standing reliance on institutional knowledge, and an ongoing gray-to-green workforce transition² have contributed to diminished capacity.³ And the engineering, design, and production complexities of today's ships would likely have challenged the infrastructure of leading yards even in their primes. Global commercial and defense maritime players must not only replace legacy assets to bolster baseline capacity but also find ways to incorporate new capabilities, such as additive manufacturing and automation, into their yards. At the same time, they need to move quickly to recover from worsening production delays.

To address this array of challenges, many producers are choosing to revitalize and redevelop existing or legacy facilities to create cost-effective capacity quickly. This article

explores how they can avoid common pitfalls in redeveloping legacy sites and assets, successfully deploy a tested five-part redevelopment strategy, and emerge better equipped to meet growing demands within their existing yards (see sidebar, "Legacy site redevelopment: Real-world gains").

A five-part strategy for legacy site redevelopment

It is strategically savvy for commercial and defense shipbuilders, suppliers, and repair yards around the world to revamp and repurpose legacy sites and assets within their existing yards rather than incur the costs of locating, securing, and building new greenfield sites. Nevertheless, efforts to repurpose existing resources can go awry in the absence of appropriately focused and detailed advanced planning, leading to cost overruns, capacity loss during retrofitting, underuse of newfound capacity, and suboptimal performance. Five common pitfalls could prevent companies from fully realizing the benefits of reconfiguring their legacy assets (Exhibit 1).

¹ *Shipbuilding market size, share, growth, and industry analysis, by type (bulkers, tankers, containers and other ships), by application (goods transportation, passenger transportation and others), regional insights and forecast to 2032*, Business Research Insights, updated September 30, 2024.

² Varun Marya, Michael Park, Andy Voelker, and Brooke Weddle, "Navigating the gray-to-green transition in aerospace and defense," McKinsey, March 16, 2023.

³ David Sharp, "The US Navy's warship production is in its worst state in 25 years. What's behind it?," Associated Press, August 11, 2024; Megan Eckstein, "US Navy ship programs face years-long delays amid labor, supply woes," Defense News, April 2, 2024; *Navy DDG-51 and DDG-1000 Destroyer Programs: Background and issues for Congress*, Congressional Research Service, August 5, 2024.

Exhibit 1

Maritime players commonly encounter five pitfalls when redeveloping legacy sites.



Point replacement of aging assets

Replacing each worn-out or malfunctioning asset with a new but nearly identical asset, ultimately creating a duplicate of a site that is not equipped to deliver the needed output



Treating legacy sites as overflow areas

Using legacy sites as extensions of a central shop or yard, turning them into disadvantageous amalgamations of assets that no longer fit within the existing footprint



Replicating existing management systems in new facilities

Copying legacy ways of working in new facilities without first assessing operating systems to determine potential improvements, leaving inefficiencies and impediments unaddressed and potentially compounded



Filling legacy spaces with new technology without addressing bottlenecks

Assembling an array of new technologies in a legacy space rather than using the space to solve existing yard constraints, potentially heightening existing production constraints



Pursuing the path of least resistance

Making decisions based on decades of institutional knowledge or opinions of knowledgeable employees and potentially missing out on valuable opportunities, rather than fully considering alternatives from first principles or other industries

Legacy site redevelopment: Real-world gains

Some global commercial and defense maritime players that employed the approaches and processes outlined in this article to redevelop their legacy sites and assets for increased capacity realized a number of benefits.

Substantial savings in capital project time and cost. One shipyard expects to save more than 85 percent in capital

expenditures on a new fabrication and assembly facility while reducing the time to launch by more than three months by pursuing legacy site redevelopment over greenfield construction and finding creative ways to repurpose and retool assets.

Process and footprint optimization. One leading shipbuilder removed a major asset from its main production line after

identifying an opportunity to consolidate production capabilities on other assets using additional tooling attachments. In addition to enabling cost savings, removing this asset created new footprint capacity and reduced material movement by approximately 10 percent.

How can producers sidestep these pitfalls? With strategic actions that, together, make up a tested, five-part approach to redeveloping legacy sites (Exhibit 2).

The following sections of this article discuss the five-part strategy producers can use to maximize the impact of extensive legacy site redevelopment.

1. Rigorously prioritizing constraints on throughput

Most environments in the global commercial and defense maritime industry encompass high-complexity production and construction, which makes identifying and managing dynamic constraints in real time a complicated undertaking. Product value streams are complex and intersecting, constraints can be numerous and

Exhibit 2

A five-part strategy can help commercial and defense maritime players avoid common pitfalls and maximize throughput in redeveloped sites.

- 1 Rigorously prioritizing constraints on throughput**
 - Define specific objectives (eg, debottlenecking a specific program)
 - Share objectives widely across the organization
 - Use objectives as a North Star to guide informed trade-offs throughout the process
- 2 Adhering to objective principles for site design**
 - Set up core design principles and evaluative principles in advance
 - Create at least three different designs that range from aspirational to the minimal viable solution as a check against potential biases in decision making based on the status quo or historic and outdated criteria
- 3 Incorporating people-centric design elements**
 - Cultivate a people-centric company culture with open spaces for gathering and relaxing as well as convenient on-site facilities to foster better work–life balance, retain talent, and mitigate workforce shortages
- 4 Building a strong digital backbone**
 - Ensure that information technology (IT) and operational technology (OT) can provide transparent, real-time data on the status of work in progress, assets, staffing, demand, and supply to maximize ROI, capacity, and throughput
- 5 Finding creative ways to reduce project risks and costs**
 - Once designs are complete, assess existing assets, resources, and in-flight initiatives to identify potential opportunities to realize efficiencies

variable, and data systems are often not equipped to illuminate and prioritize constraints to inform real-time decisions and maximize throughput while ensuring uncompromised safety and quality.

In such environments, choosing how best to repurpose and redevelop a legacy site to expand capacity and boost performance—or making any strategic decision—can be fraught. Companies that make decisions informed by conventional wisdom, the loudest voice in the room, the wrong indicators, or noisy data run the risk of prioritizing bottlenecks incorrectly or suboptimally. And getting it wrong is almost always costly: more than one company has spent millions of dollars and many years on redevelopment projects that result in no net change in costs or schedule performance when unidentified or deprioritized bottlenecks prove to be rate limiting.

In our experience, companies that successfully address their most limiting, highest-priority constraints with site redevelopment tend to conduct detailed critical-path analyses regularly,

identify and prioritize constraints, and understand the root causes of those constraints sufficiently to address them effectively.

Conducting regular critical-path analyses.

Analysis should be detailed enough to describe any single component, asset, or process and estimate its impact on production timelines, enabling teams to identify and prioritize constraints in all major value streams (Exhibit 3).

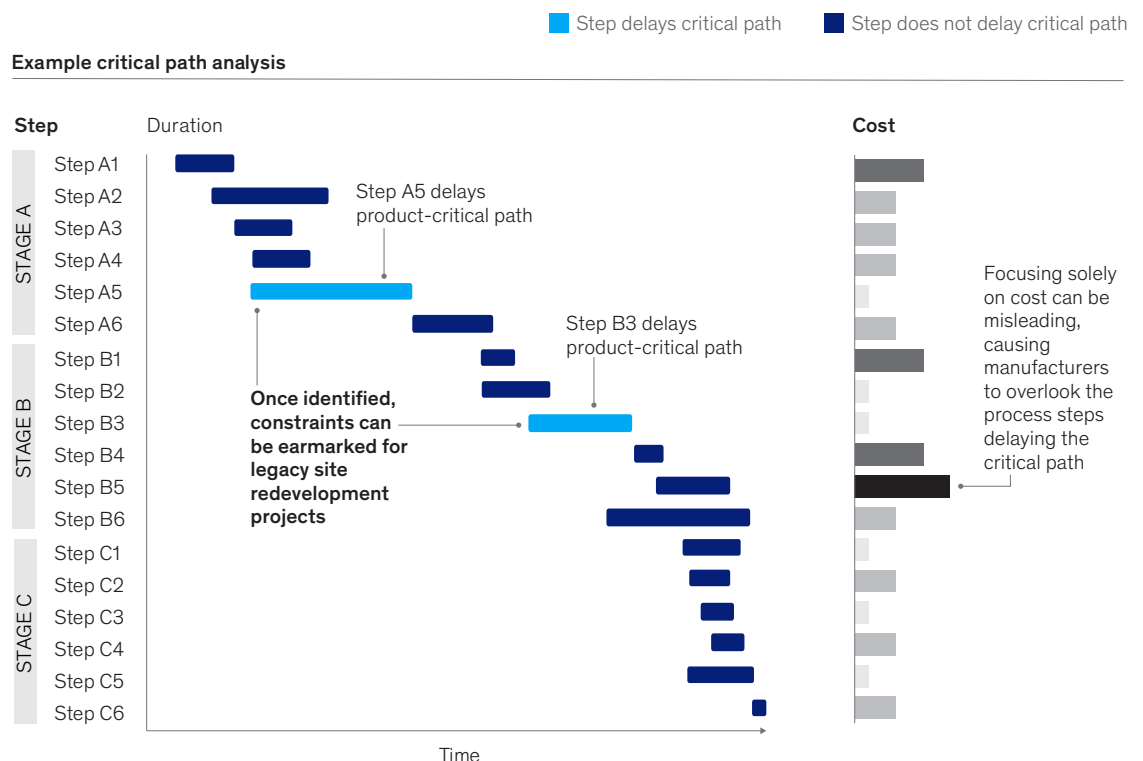
Understanding the root causes of priority constraints. The level of understanding should be sufficiently granular to support and guide design efforts to remove prioritized constraints from the operating system during facility redevelopment.

There are typically two types of root causes for bottlenecks in a complex value stream:

- capacity limitations, caused by overloaded assets and teams, or inadequate first-pass quality, creating rework

Exhibit 3

Identifying the true constraints underlying production delays helps leaders determine what to address during legacy site redesign.



- flow-related slowdowns caused by breakdowns in coordination and sequencing between process steps

By gaining a full understanding of the root causes of priority constraints, companies can proceed knowing exactly what needs to change in the future site to ensure that issues are addressed safely, sustainably, and with the utmost quality.

2. Adhering to objective principles for site design

In the design phase of a legacy site redevelopment project, it is often tempting to rely on past experience to guide design efforts. However, we have observed that redesigning facilities around objective principles tends to lead to better outcomes—that is, improved throughput at lower cost. Four such principles can be used nearly universally to guide legacy site redevelopment, design, and planning: promoting end-to-end visibility into the value stream; employing simple, efficient flows; prioritizing product throughput over asset utilization; and adopting an iterative design approach.

- **Promoting end-to-end visibility into the value stream.** When it comes to maximizing visibility, housing the full value stream under one roof is ideal. Products can be seen, routings can be walked, and waste has fewer places to hide. Visibility can be enhanced easily by adding standard material laydown areas and kanban to see progress along the value stream and instituting “stop work” criteria to help prevent job buildups and illuminate bottlenecks. Teams can gain additional control of their supply chain destinies by ceasing to source problematic components or manufacturing processes from external third parties and instead creating them in-house.
- **Employing simple, efficient flows.** In complex manufacturing, focusing on optimizing the flow of each component can help pinpoint wasted steps to reduce batching, cycle times, and movement to improve quality, repeatability, and rate.⁴

- **Prioritizing throughput over asset utilization.** Many complex operations employ process-focused systems that prioritize groupings of similar capabilities to optimize costs within a constrained footprint. When redeveloping legacy sites, however, this approach can often lead to underused capacity. Instead, it is helpful to base site design and production system layout decisions on throughput, the primary objective for expanding capacity. In some cases, such an approach may favor product-focused operating systems over traditional process-focused production.

- **Adopting an iterative approach to site design.** Adhering to the principles noted above can be challenging, and it is unlikely that the best design will be achieved on the first try. Rather, the best design typically emerges after following an explicitly iterative and cross-functional approach, beginning with at least three designs: one aspirational, one incremental, and one a middle ground between aspirational and incremental. Exploring the full range of possible designs yields a common understanding of realistic constraints and opportunities, and often spurs further creativity.

Companies can maximize throughput by keeping these four principles at the heart of key decisions about site selection and layout design. Although implementing these actions may prove challenging for global shipyards and repair yards with deeply entrenched ways of working, ultimately they create the conditions to maximize performance of nearly any revitalized legacy site (Exhibit 4).

3. Incorporating people-centric design elements

Many players in the global commercial and defense maritime industries (yards and their suppliers) face mounting workforce challenges.⁵ Plagued by a rapidly aging workforce, rising attrition levels, and a difficult hiring environment, employers are finding it increasingly tough to maintain the right labor supply to meet growing demand.⁶ McKinsey research shows that in the United States alone,

⁴ “Why flow matters most in highly complex manufacturing,” McKinsey, May 3, 2024.

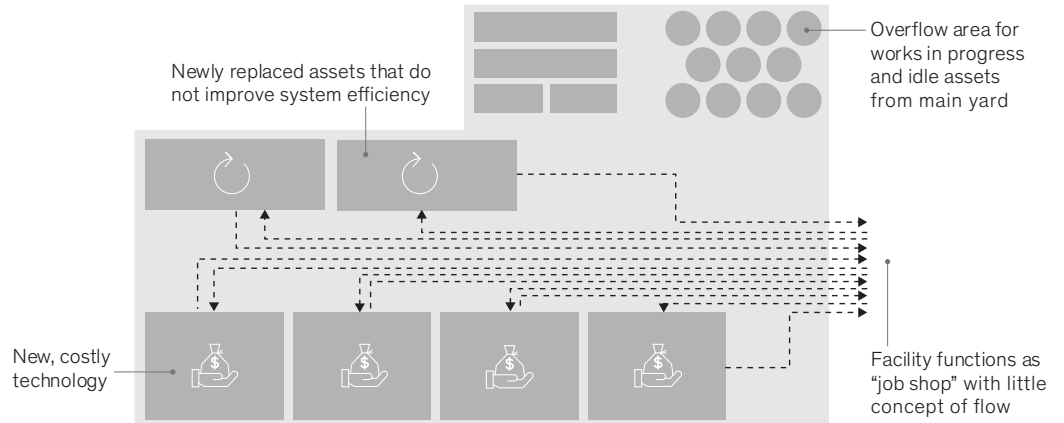
⁵ “Navigating the gray-to-green transition,” March 16, 2023.

⁶ Ibid.

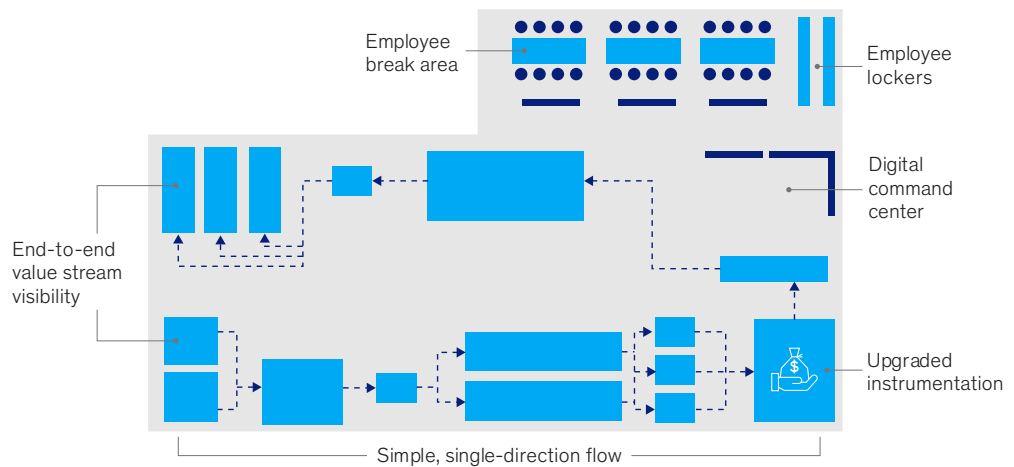
Exhibit 4

Strategically redesigning legacy facilities can unlock throughput by enhancing capabilities and flow.

Example legacy site



Example strategically redesigned legacy site



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employers expect annual hiring to be more than 22 times the projected annual increase in net new jobs due to churn. One significant contributing factor? Skilled-trades jobs in global commercial and defense maritime are physically quite demanding. Meanwhile, the barriers to entering new career paths (gig work, for example) are declining along with the cost of switching jobs. And there are many new jobs available—with fewer physical demands in newer facilities and at comparable wages—that pose a significant threat of diverting employees

who might otherwise have pursued maritime skilled trades.

Indeed, employees' expectations for when, where, and how they work have evolved. While other sectors have raced to keep up, most legacy sites are not equipped to accommodate employees' new priorities. Legacy layouts and aesthetics tend to favor efficiency above all else, for example, so welcoming, comfortable spaces for employees to gather, eat, exercise,

or relax are limited or nonexistent. In advanced industrial manufacturing, the presence or absence of workplace flexibility (related to physical work settings for those in skilled trades) is a top reason why employees decide to join, remain at, or leave a company.⁷ Thus, the ROI on architectural design is clear, and companies can capture it by incorporating people-centric architectural elements into legacy site redevelopment, elevating the appeal of their entire site with targeted capital deployment.

No-regrets people-centric architectural elements can include the following:

- comfortable, open spaces for recreation, socializing, and relaxation
- ample parking and transportation options for commuting employees
- timely, engaging, and relevant visual communication aids
- dedicated and comfortable communal eating spaces
- quiet break rooms where employees can rest before and after shifts

Larger investments in people-centric elements could include the following:

- on-site childcare facilities
- on-site exercise and shower facilities to help employees maximize their personal time and health

In our experience, many of these elements can be incorporated with only minor adaptations to design, marginal floor space, and little cost relative to the full redevelopment effort. They can also have an outsize impact on productivity.⁸

4. Building a strong digital backbone

Legacy sites often predate the digital age; consequently, they may contain a hodgepodge

of digitally enabled and non-digitally enabled assets. Few legacy sites have a strong digital backbone with an information technology (IT) and operational technology (OT) stack capable of providing transparent, real-time data on the status of work in process, assets, staffing, demand, and supply. Unless companies include investments in technology upgrades as part of their legacy site redevelopment, they can fall short when it comes to maximizing capacity and miss an opportunity to use the site as a digital testing ground to accelerate innovation across the organization.

Thus, developing a digital backbone design for a legacy site alongside the physical layout design is imperative to maximize the new site's capacity, efficiency, and ROI. A strong digital backbone gives operating leaders the ability to see and prioritize constraints to make informed decisions in real time. Such a system requires, at a minimum, four basic components:

- instrumentation on assets to measure overall equipment effectiveness in real time
- transparent, real-time signals for supply and demand
- dynamic planning and scheduling systems to guide production
- tracking and daily progress measurements for work in process, inventory, and individual operator performance

In addition to unlocking the ability to quickly pilot different technologies before scaling them across the network, companies that design and implement a strong digital backbone can build new digital deployment capabilities in their organization that may have been unattainable otherwise.

5. Finding creative ways to reduce project risks and costs

Once the site and layout have been selected for redevelopment, it is important to relaunch the legacy site as quickly and cost-effectively as

⁷ Brooke Weddle, Giulietta Poltronieri, Hugues Lavandier, and Andy Voelker, "The talent gap: The value at stake for global aerospace and defense," McKinsey, July 17, 2024.

⁸ Ibid.

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possible. In many cases, the site must remain operable during design and refitting, further complicating redevelopment and adding constraints. At this stage, companies often make two potentially costly mistakes:

- compromising their objective design principles to accommodate existing assets and then designing around self-imposed constraints
- creating prohibitively complicated and expensive plans that cause construction and ramp-up delays and ultimately diminish the benefits of redevelopment

To avoid these pitfalls, manufacturers can deploy several levers to keep costs low and compress the time it takes to launch a newly redeveloped and fully operational facility:

Repurposing existing assets without compromising design principles. Only after facility designs have been created can teams examine the new layout for minor modifications to incorporate existing assets, fixtures, or other capital equipment. In so doing, it is important to ensure that the modifications still achieve the underlying design principles as well as the throughput and reliability demands of the envisioned facility.

Rigorously managing five key milestones. Five milestones in the redevelopment cycle are especially important to maintaining the scheduled timeline: engineering and design,

procurement, site preparation, asset commission, and production ramp-up. Project plans should be scrupulously detailed and rigorously managed. For example, one rigorous site redevelopment plan encompassed more than 30 individual initiatives, and project teams met daily to address constraints and risks.

Engaging in strategic partnerships. Complex advanced industrials can derisk legacy site launches and reduce costs through strategic public and private partnerships. Collaborations with local governments can help clarify site permitting requirements, for example, while private partnerships can provide essential capital. Potential partners include local economic development groups, private equity firms, government entities, and universities.

Redeveloping legacy assets and sites offers many industries, including the global commercial and defense maritime industry, an opportunity to physically expand capacity to meet higher throughput demands at a fraction of the time and expense required for equivalent greenfield construction. The model for success is evident: clearly defining and prioritizing constraints on throughput, adhering to objective principles to guide site selection and design, incorporating people-centric elements and a strong digital backbone, and using creative means to lower project risks as well as costs.

Brooke Weddle is a senior partner in McKinsey's Washington, DC, office, where **Sean Cassady** is a consultant; **Nick Mellors** is a partner in the Seattle office; **Ryan Brukardt** is a senior partner in the Miami office; **Andy Voelker** is an associate partner in the Boston office; and **Benjamin Plum** is an associate partner in the New York office.

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