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Labor Market Impacts on Navy Shipbuilding & Fleet Efficiency

Billy Fabian—is Govini's Vice President of Strategy. Prior to Govini, Fabian was a Research Fellow at the Center for Strategic and Budgetary Assessments. Fabian worked for the Department of Defense as a Senior Strategic Analyst in the Office of the Deputy Assistant Secretary of Defense for Strategy and Force Development. He holds a Master of Public Administration in international security policy from Columbia University's School of International and Public Affairs. Fabian is also currently an Adjunct Senior Fellow in the Defense Program at the Center for a New American Security (CNAS).

Dr. Jen Gebhardt—is a senior analyst at Govini and leads the analysis supporting the Shipbuilding Industrial Base Task Force. Prior to joining Govini, Gebhardt was an Assistant Professor at Loyola Marymount University where she conducted research on political communication and taught political science and empirical research methods. Jen holds a BA in Government and Politics from the University of Maryland and received a PhD in political science—political psychology from the University of California, Irvine.

Abstract

The Department of Defense relies on a range of highly specialized—and in many cases, dwindling—skill sets in order to deliver critically needed military capabilities and weapons systems. In order to achieve its long-term shipbuilding plan, the Navy requires a data-driven understanding of the labor economics associated with commercial shipyards and relevant labor categories. In this decision science analysis, Govini conducts a labor market analysis that assesses the current and future balance between the supply of and demand for labor in the specific, critical trades that are requirements of shipbuilding.

Introduction

Seapower has always been vital to the political influence, military might, and economic prosperity of the United States. With strategic competition between the United States and the People's Republic of China intensifying and Russia remaining an acute threat, the U.S. military must defend far-flung interests in the Indo-Pacific and Europe. As a result, seapower remains as vital as ever.

Since the first six U.S. Navy frigates were laid down at the dawn of the republic, U.S. seapower has been underpinned by a strong and innovative shipbuilding industrial base. Prevailing over China in the Indo-Pacific and beyond depends on the continued health of that base. Accordingly, the Department of the Navy is undertaking a comprehensive evaluation of national shipbuilding capacity

The lifeblood of the shipbuilding industry has always been the skilled tradespeople that make up its labor force. Over the last few decades, however, changing patterns in U.S. military ship buying, new trends in the domestic and global commercial ship market, social and cultural perceptions favoring non-vocational training, and economic downturns have combined to exert significant strain on the shipbuilding industrial base labor force. Conditions have been further exacerbated over the last two years due to the damage wrought by the COVID-19 pandemic.

As part of the comprehensive evaluation of national shipbuilding capacity, the Navy's Shipbuilding Industrial Base Task Force (SIB-TF), sponsored by the Office of Secretary of Defense (OSD) Industrial Base Analysis and Sustainment (IBAS) office, tasked Govini to analyze and assess the macro- and micro-economic dynamics that shape the current and future labor market for critical trades relevant to Navy shipbuilding. To conduct the study, Govini employed decision science—the targeted application of machine learning and data at scale—to fuse disparate data sources, analyze historical trends, and forecast future labor market



conditions. The study focused on labor force dynamics in the Gulf Coast region for four trades critical to the shipbuilding industrial base: Electricians, Metal Fabricators and Fitters, Inside Machinists, and Riggers. This focus was selected both to produce immediate insights for a region vital to U.S. shipbuilding and to build a rigorous and generalizable analytical model that could be used to assess other regional and/or national labor market dynamics. The study addressed two key questions:

- 1) Is there an adequate supply of skilled labor in select critical trades to meet current and projected demand for Navy ship construction in the U.S. Gulf Coast?
- 2) What drives supply and demand for select critical trades in the U.S. Gulf Coast?

The insights illuminated by the study can aid decision-makers in the Department of the Navy, Defense Department, the U.S. Coast Guard, Maritime Administration, and broader U.S. Government as they grapple with the challenges of maintaining a healthy shipbuilding labor force.

Key Findings

- **Demand for workers in the four critical trades is increasing—but not from Navy shipbuilding.** Wage trends and job vacancy data suggest current demand for workers on the Gulf Coast in the four critical trades analyzed is increasing. However, Navy shipbuilding does not appear to be driving this trend. In fact, demand for workers generated by Navy shipbuilding has declined 38% from its peak in 2016.
- **The supply of workers in the four critical trades is largely flat.** The assessed labor force in the Gulf Coast region for the four critical trades analyzed has not grown significantly from 2015 levels. Moreover, the labor force of riggers and metal fabricators and fitters in non-Gulf Coast regions of AL, FL, LA, and MS has declined significantly since 2018, reducing the potential pool of workers in the southeast region that could be enticed into shipbuilding.
- **Navy shipbuilders can expect sufficient labor capacity for electricians and riggers, but insufficient capacity for inside machinists and metal fabricators and fitters.** The supply and demand for electricians and riggers is expected to be balanced from 2022–2026. But there is projected to be an imbalance in the supply and demand of inside machinists and metal fabricators and fitters in the Gulf Coast region over the same period.

Methodology

The study analyzed historical data to forecast future supply and demand trends in the Gulf Coast region for four trades critical to the shipbuilding industry: Electricians, Metal Fabricators and Fitters, Inside Machinists, and Riggers. Govini conducted this study in two phases, each consisting of eight steps. The eight steps undertaken in each phase are depicted in Figure 1.



ANALYTIC APPROACH

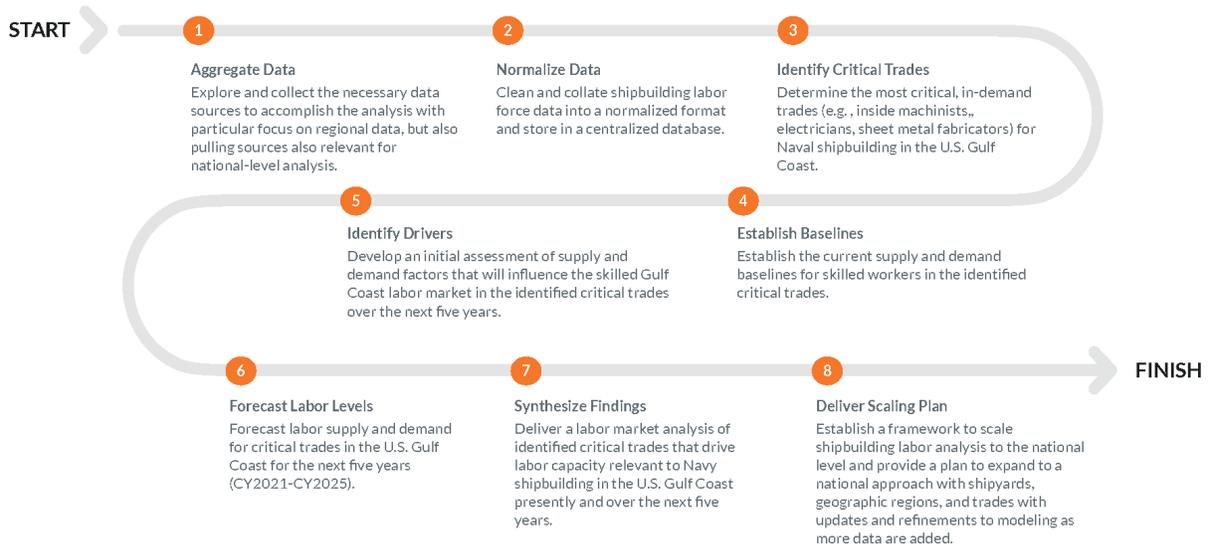


Figure 1. Analytic Approach

In the first phase, the study fused disparate U.S. Government and commercial market data to establish a baseline of historical supply and demand for the four critical trades from 2015 to the present. The study then leveraged this historical baseline to build a model to forecast future supply and demand trends. The forecasting model enabled Govini to assess future labor conditions and produce a series of initial insights.

In the second phase, the study incorporated additional data sources, such as data on workload by ship class, job vacancy postings, and adjacent occupations with common skills. This enriched data enhanced the robustness of the historical supply and demand baseline and enabled Govini to further refine the forecasting model. The study then used the refined forecasting model to generate insight on future labor market conditions to inform the SIB-TF’s deliberations.

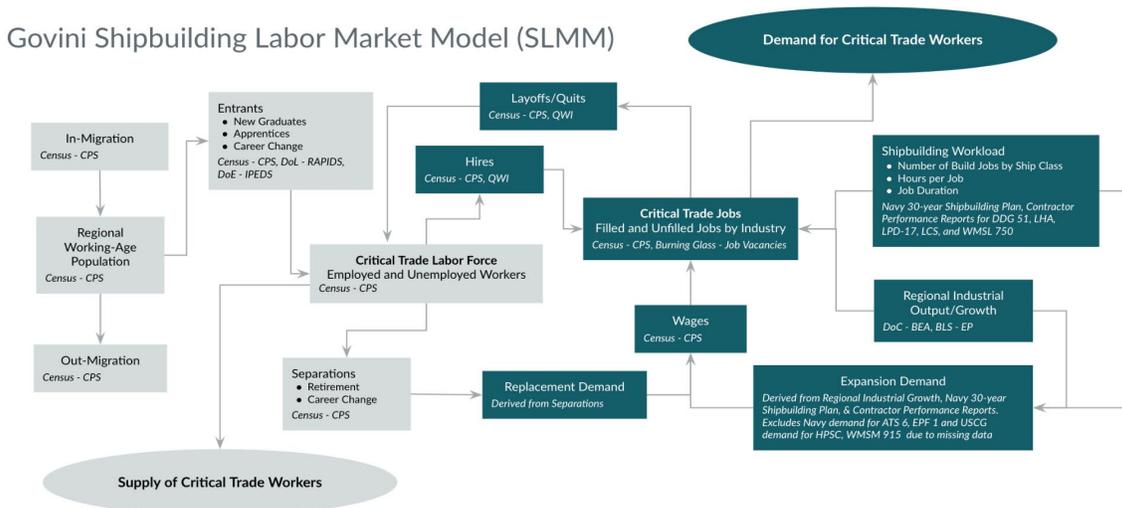


Figure 2. Govini Shipbuilding Labor Market Model (SLMM)



At the heart of the methodology is Govini's Shipbuilding Labor Market Model (SLMM), which is depicted in Figure 2. The SLMM is built from an informed set of predictors that enable a data-driven approach to labor forecasting. The outputs of this model are ultimately designed to help the Navy, Congress, shipyards, and all other stakeholders to prepare the workforce and secure the shipbuilding industrial base for the future.

To identify factors that affect the market for skilled labor, Govini completed a thorough review of the academic and professional literature on labor economics and labor forecasting, as well as shipbuilding and repair. This review also informed data collection efforts as well as the statistical and analytic approaches used to calculate labor baselines and model future labor capacity. The model architecture is designed to be modular, generalizable, and therefore capable of being applied to additional geographies and/or trades.

Govini applied the SLMM to capture regional trends within the Gulf Coast shipbuilding industry and assess labor supply and demand around selected critical trade occupations and skills. The demand-side model encompasses Navy shipbuilding projects, repair workloads, wages, job vacancies, and growth in adjacent industries that employ workers with the same skill sets and compete with each other for the same workers.

The supply-side model encompasses employment, unemployment, wages, training programs, career changers, retirements, new graduates, apprenticeships, working-age population, and net migration. The labor market analysis also identified other industries in the region that employ workers with similar skill sets. The study then used these models to forecast five-year trends and assess future labor supply conditions in the context of the Navy's shipbuilding and repair plans.

Analysis

U.S. Navy shipbuilding workload for the four critical trades in the Gulf Coast region has been decreasing since late 2016 and is projected to continue trending downward until 2025 when it is forecasted to begin rebounding slightly. As illustrated by Figures 3 and 4, which depict the combined shipbuilding workload by ship class and trade over time, workload peaked in Q3 2016 when 20 distinct hulls were under construction. Beginning in 2017, however, workload began to decrease, declining by 38% from the 2016 peak by the end of 2021. The projected workload is forecasted to decline into early 2025, then begin to rebound as LPD 31, LPD 32, LHA 9, DDG 133, DDG 135, and DDG 137 begin to ramp up production. This rebounding, however, is not expected to reach 2016 peak levels during the period assessed.



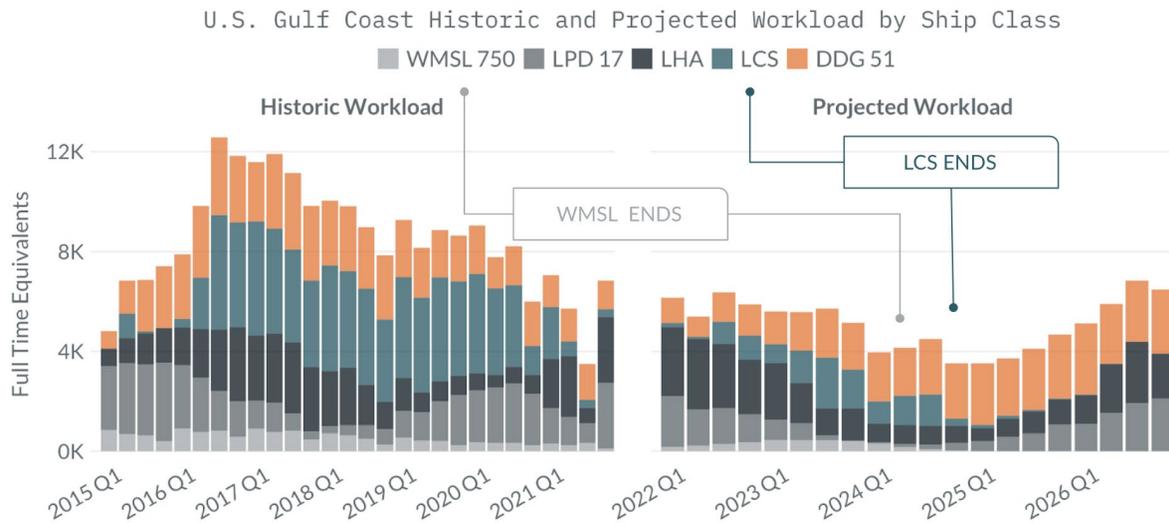


Figure 3. U.S. Gulf Coast Historic and Projected Workload by Ship Class

At the same time, the overall demand for labor in the four critical trades is increasing in the Gulf Coast region. Wage trends and job vacancy data suggest current demand for workers in these trades on the Gulf Coast is increasing. With the exception of riggers, wages for the trades in AL, FL, LA, and MS have increased since 2015. Wages in the Gulf Coast region are also relatively higher than wages in non-Gulf Coast regions of AL, FL, LA, and MS, signaling a tighter labor market in shipbuilding areas. Job vacancies in both the Gulf Coast and non-Gulf Coast regions of AL, FL, LA, and MS have increased upward of 40% since the second quarter of 2020, signaling a rapid increase in worker demand post-pandemic. Critically, not only has this increase in demand not been driven by U.S. Navy shipbuilding, but it has also largely not been due to commercial shipbuilding either. Rather, other industries—such as construction and oil and gas extraction—have been responsible for the increase in demand for these trades in the Gulf Coast region.

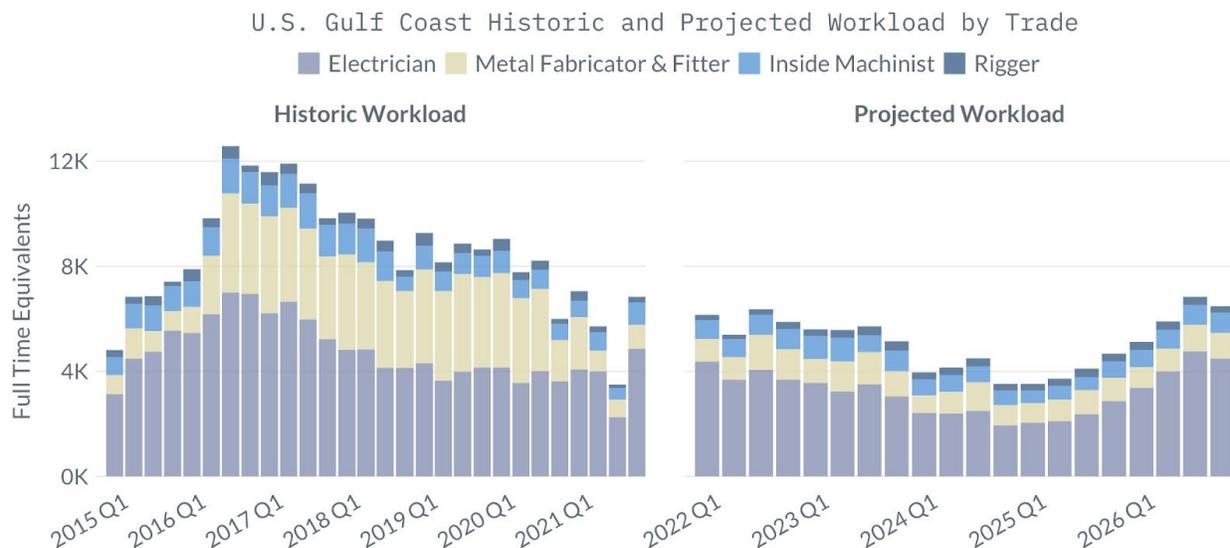


Figure 4. U.S. Gulf Coast Historic and Projected Workload by Trade



Although demand for these trades has been increasing, the supply of workers has remained largely flat since 2015. Moreover, the labor force of riggers and metal fabricators and fitters in non-Gulf Coast regions of AL, FL, LA, and MS has declined significantly since 2018, reducing the potential pool of experienced workers in the southeastern United States that could be enticed into shipbuilding. This imbalance between surging commercial demand outside the shipbuilding industry and flat supply for workers in these critical trades could have significant implications for the future health of the shipbuilding industrial base.

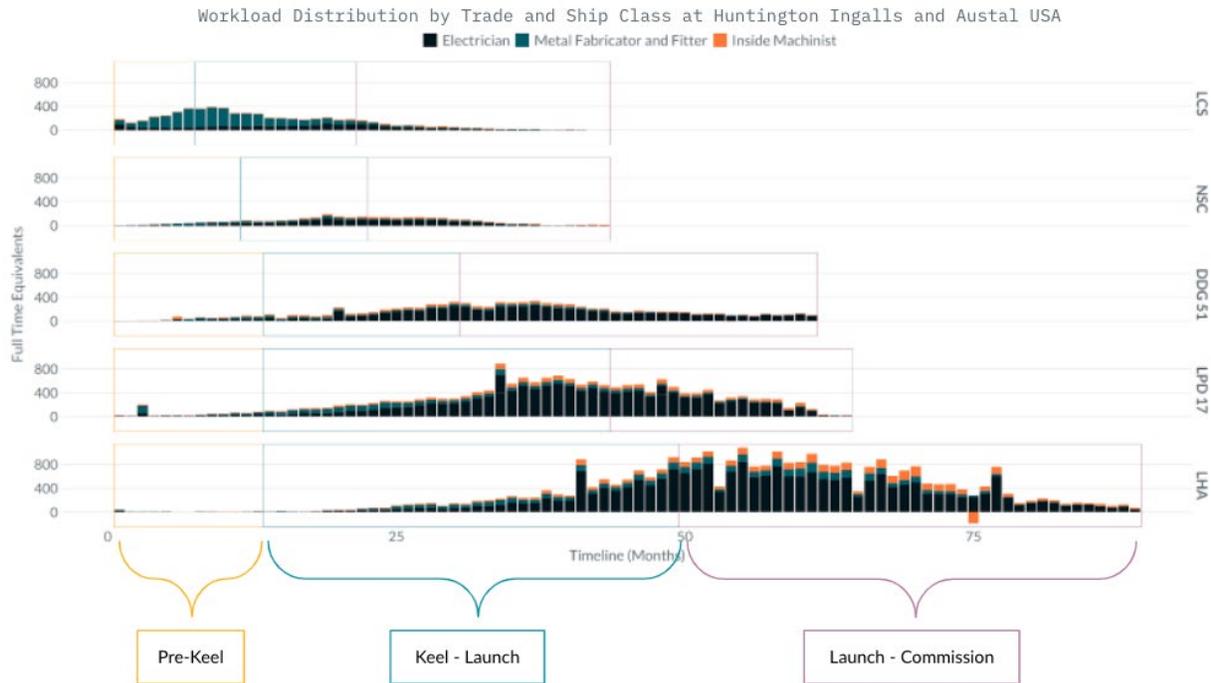


Figure 5. Workload Distribution by Trade and Ship Class at Huntington Ingalls and Austal USA

Given the increasing imbalances between labor supply and demand of the four critical trades in the Gulf Coast region—and the potential implications of these imbalances for the health of the shipbuilding industrial base—the study utilized the SLMM to forecast future labor conditions. The forecasts indicate that there should be sufficient labor capacity in the Gulf Coast region for electricians and riggers through 2026. The supply of inside machinists and metal fabricators and fitters, however, will likely face labor shortfalls through 2026.

Because all forecasts are associated with uncertainty, Govini captured a range of possible scenarios that the model predicts within a specified probability for each of the four trades, the outcomes of which are depicted in Figures 6 and 7:

- **Average:** Average predicted supply minus average predicted demand (represented by forecast trendlines)
- **Best:** Highest predicted supply value minus lowest predicted demand value (95% probability)
- **Worst:** Lowest predicted supply value minus highest predicted demand value (95% probability)



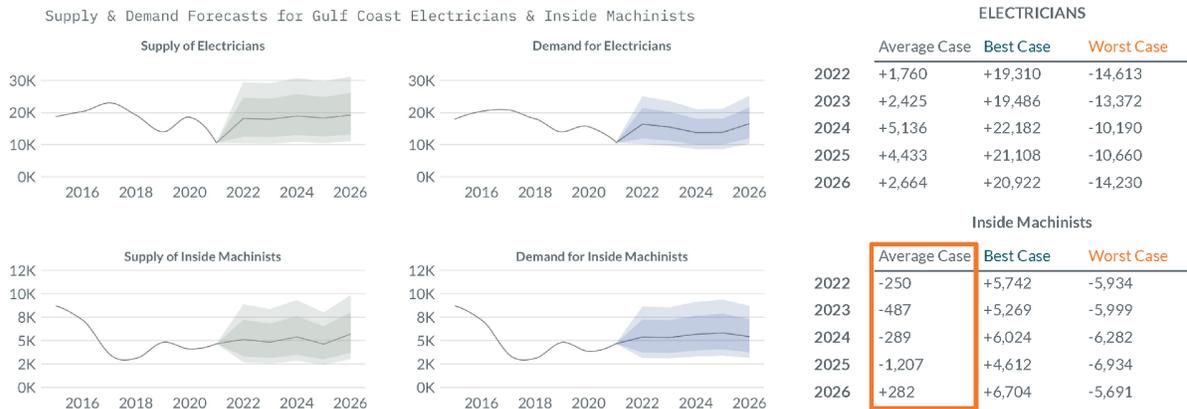


Figure 6. Supply and Demand Forecasts for Gulf Coast Electricians and Inside Machinists

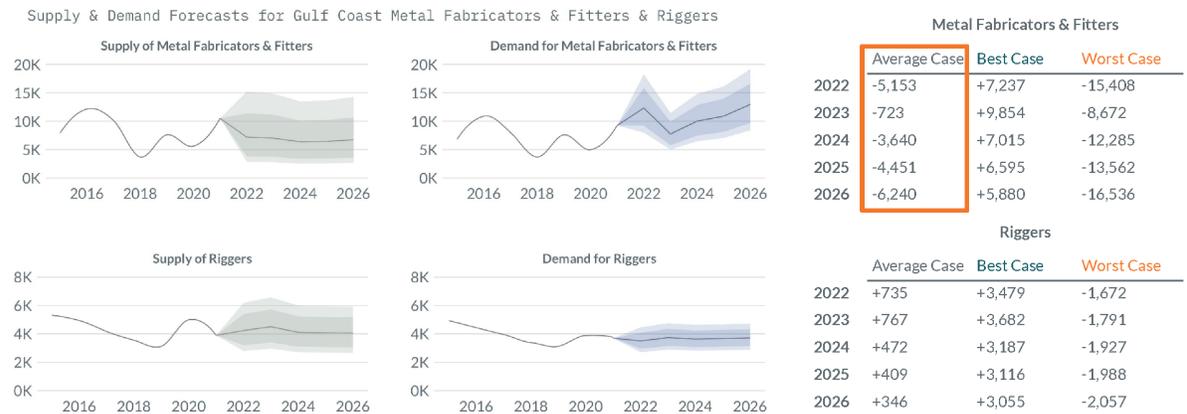


Figure 7. Supply and Demand Forecasts for Gulf Coast Metal Fabricators and Fitters and Riggers

The forecasts for metal fabricators and fitters predict both near and long-term shortfalls in capacity through 2026. The supply of workers is projected to decline and then flatten over the period, while demand is projected to grow. As a result, demand is expected to be sizably higher than supply every year in all cases but the best-case forecast. This decline in supply is largely driven by a decreasing number of new entrants into the trade.

The forecasts for inside machinists are less dire, with slight imbalances projected in the average-case forecast until 2026. The worst-case forecast projects greater imbalances through 2026, but still not as substantial in magnitude as those for metal fabricators and fitters. While demand is likely to remain relatively flat, the supply of inside machinists is likely to contract periodically over the next five years largely due to career changes and retirements, which drive the projected imbalances.

Implications for the Navy

The potential imbalance in labor supply and demand projected over the next five years for two of the four trades assessed could result in construction delays for ship classes built on the Gulf Coast. The impact of these labor supply shortfalls could fall disproportionately on smaller subcontractors that lack the resources to compete with larger companies in tight labor markets. If these subcontractors perform critical and difficult to substitute functions in the



construction process, the effects of the labor shortfalls could create bottlenecks that have cascading consequences for cost and schedule, driving outsized delays and disruptions.

Moreover, two emerging trends could further exacerbate the labor supply and demand imbalance, potentially pushing future labor market conditions closer to or even beyond the worst-case forecasts in the short to medium terms. First, increased defense budgets in the wake of the Russian invasion of Ukraine, if sustained for several years, will likely result in greater U.S. Navy ship procurement than originally planned over the future years defense plan. Second, surging energy prices and the push to cut off Russia from global oil and natural gas markets could lead to higher demand and wages for workers in these trades in the oil and gas extraction industry in the Gulf Coast region, particularly for metal fabricators and fitters.

Given the potential disruptions that imbalances in labor supply and demand could create for Navy shipbuilding plans, there are a couple of mitigation measures that the Department of the Navy, Department of Defense, the U.S. Coast Guard, Maritime Administration (MARAD), and broader U.S. Government should consider implementing. First, efforts to stabilize order quantities across the Navy, Coast Guard, MARAD, and other U.S. Government agencies—coupled with federal government assistance—could enable shipyards and their suppliers to make greater investments in their labor force, including incentivizing retention to deter potential career changers and increasing wages to entice more new entrants and/or career changers. Stabilizing total orders over time will always be a challenge given uncertain future fiscal environments. But as noted in Figure 5, demand for each trade over time differs by ship class. As such, the Navy, Coast Guard, MARAD, and other agencies could seek to stagger class procurement to smooth labor demand over time.

Second, the Navy could forge partnerships with state and federal agencies to increase outreach and incentives for younger cohorts to enter training programs and apprenticeships. These measures could help to both expand the total pool of workers in the critical trades while infusing it with younger workers that will help lessen the risk of future shortages due to mass retirements. Interestingly, high demand in industries outside of Navy shipbuilding are drivers of acute labor imbalances, they may serve both to increase the pool of workers in the four critical trades while lowering the average age of workers in that pool in the longer term. Sustained high demand in industries like oil and gas extraction could lead to higher wages and steady work that attract new entrants to the trades. As a result, the Navy should consider how it can leverage these trends to funnel more new entrants into training programs to increase the pool of skilled tradespeople, thereby increasing the health of the shipbuilding industrial base and its resilience to future negative shocks.

Next Steps

In order to further refine the SLMM and use it to expand the assessment of the health of the shipbuilding industrial base, initial discussions with Navy and IBAS sponsors have explored the potential of applying the SLMM to new shipbuilding trades and to a new shipbuilding region, such as New England. This would allow for validation of the SLMM and relevant comparison of data between the unique labor dynamics of the Gulf Coast and New England. Additionally, as mentioned above, the team identified that the supplier ecosystem that supports the shipyards may have more critical labor risks than the yards themselves because of their business size and location. The shipbuilding and submarine industrial base supplier networks are geographically dispersed across the country making mapping by place of performance, categorizing by sub-industry, and prioritizing by systems across the supplier base a recommended and necessary step. The team can then quickly assess industry-level labor trends and risks for the shipbuilding industrial base by market sector and location.



Appendix: Deep Dives into Critical Trades

This appendix provides more detailed information on each of the four critical trades analyzed in the study. It focuses on four areas: proportion of labor demand for each trade from U.S. Navy shipbuilding versus other industries, including commercial shipbuilding; primary industries outside of U.S. Navy shipbuilding driving labor demand for the trade; annual rates of new entrants from educational programs and net career changers in the labor supply for the trade; and age distribution of workers within the labor supply for the trade.

Electricians

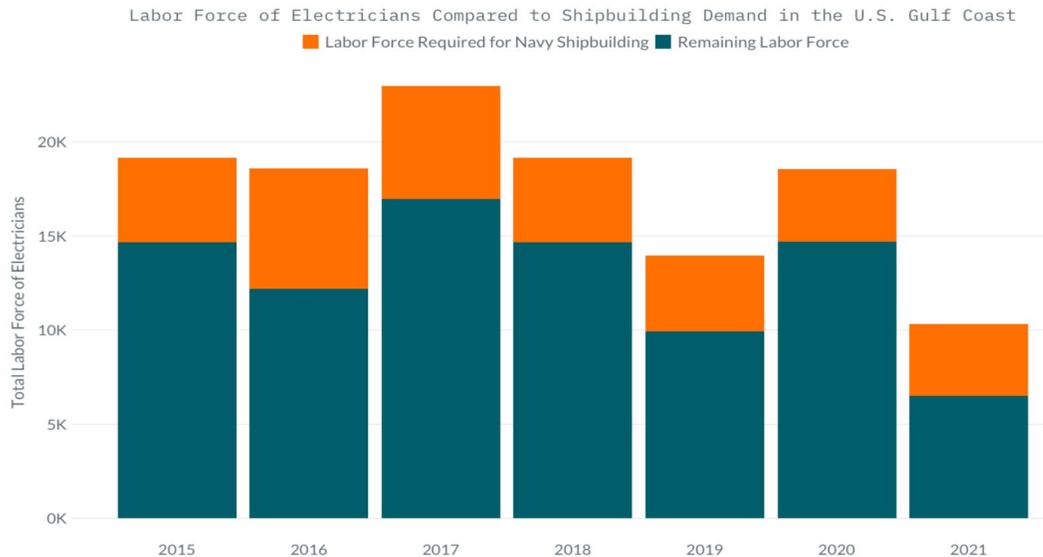


Figure 8. Labor Force of Electricians Compared to Shipbuilding Demand in the U.S. Gulf Coast

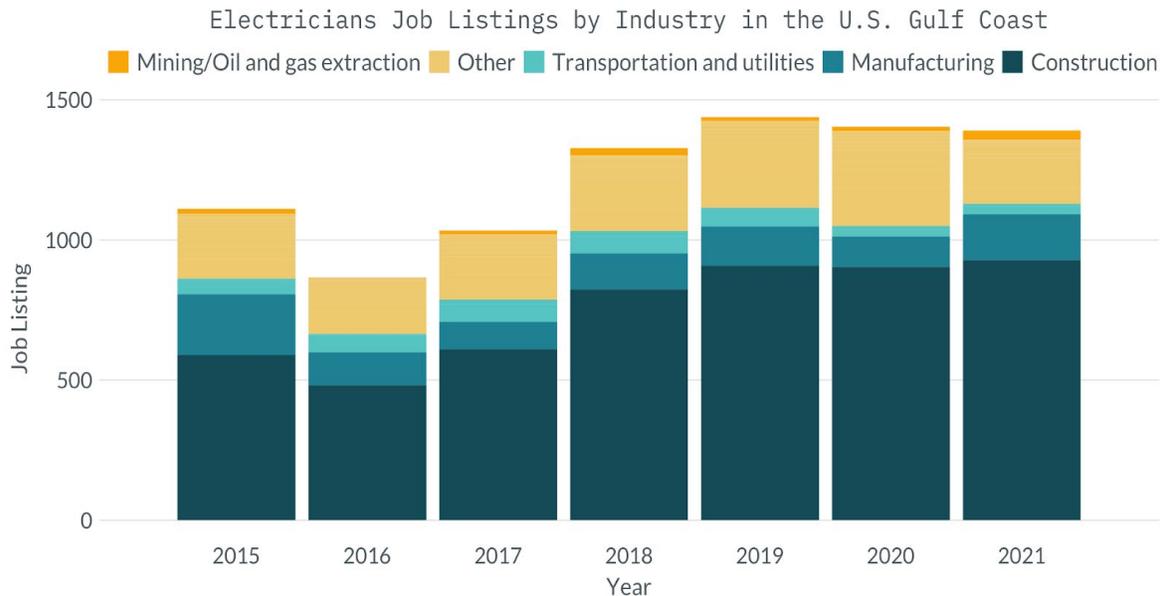


Figure 9. Electricians Job Listings by Industry in the U.S. Gulf Coast



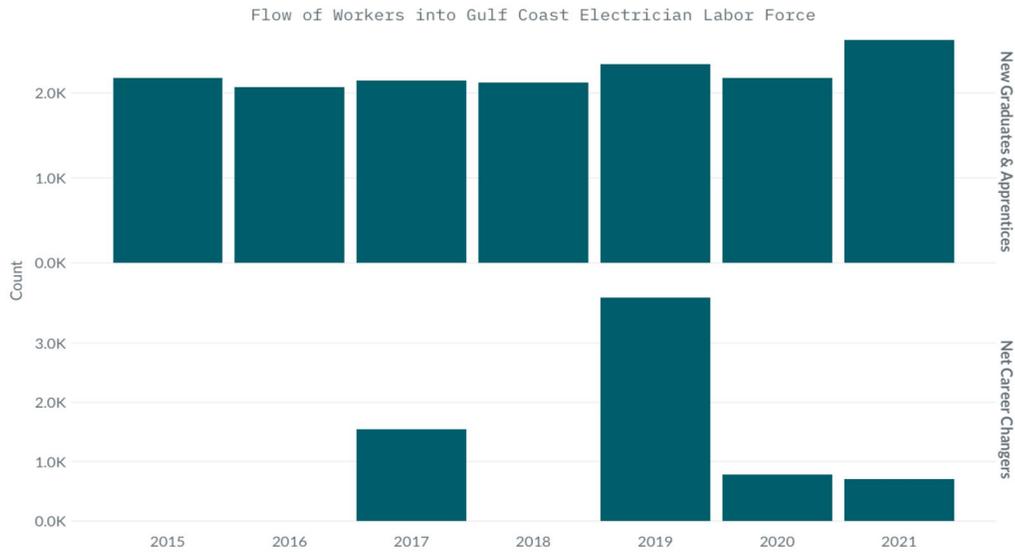


Figure 10. Flow of Workers into Gulf Coast Electrician Labor Force

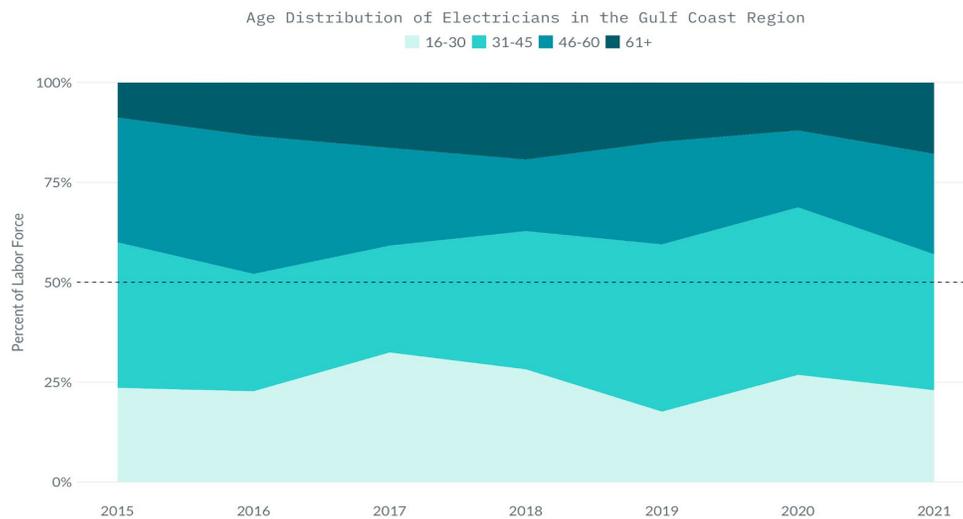


Figure 11. Age Distribution of Electricians in the Gulf Coast Region

Labor Demand Proportions: Electricians working in Navy shipbuilding comprise a minority of the total labor force of electricians in the Gulf Coast region, representing less than one-third of total labor demand for the trade. Despite periodic fluctuations, the proportion of the labor force required for Navy shipbuilding has remained steady since 2015, averaging around 28% of the total Gulf Coast electrician labor force from 2016–2021.

Industries Driving Demand: Outside of shipbuilding, the majority of job listings for electricians are in construction indicating high demand in this industry. From 2015 to 2021, 61% of job vacancies for electricians were in construction. The demand for electricians in the construction industry grew at an 8% compounded annual growth rate (CAGR), with the largest change occurring between 2017 and 2018, which saw a 35% increase in job posts. From 2015 to 2021, job vacancies in the manufacturing industry dropped by 4% CAGR. Although job vacancies in the mining/oil and gas extraction industry account for only 1.4% of all vacancies, the number of job posts in this industry experienced the largest growth at 10% CAGR between



2015 and 2021.

New Entrants and Net Career Changers: There was marginal growth in the electrician labor force in the region from new graduates, apprentices and net career changers. From 2015 through 2021, the number of new electrician graduates and apprenticeship completers in the Gulf Coast region grew at 3.2% CAGR. On average, 2,200 electricians enter the labor force from postsecondary institutions, including community colleges, as well as apprenticeship programs. Electricians do not appear to be prolific career changers with, on average, only a couple hundred workers switching into the trade each year. Still, from 2015 to 2021, more workers changed careers *in* the electrician trade than *out*.

Age Distribution in the Labor Supply: The majority of electricians in the Gulf Coast region are 45 or younger, signaling a low risk of mass retirement. The age distribution of electricians in the Gulf Coast region is stable and healthy. The age distribution of electricians in the non-Gulf Coast region mirrors that of electricians in the Gulf Coast region. In 2021, 42% of the non-Gulf Coast region labor force was 45 or older whereas 44% of the Gulf Coast region labor force was 45 or older.

Inside Machinists

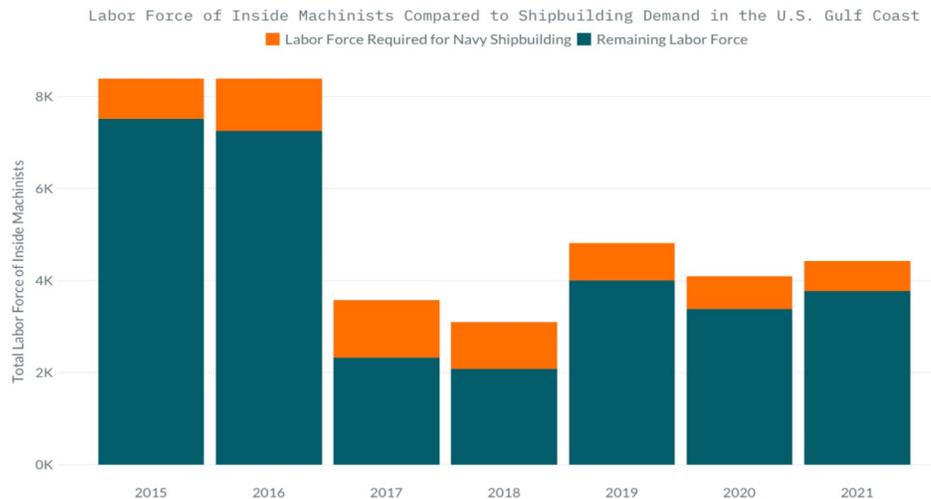


Figure 12. Labor Force of Inside Machinists Compared to Shipbuilding Demand in the U.S. Gulf Coast

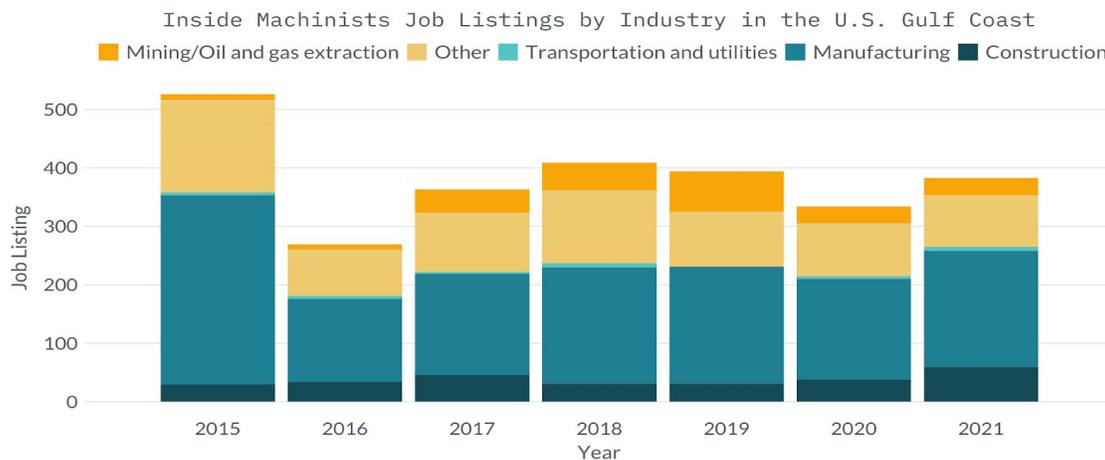


Figure 13. Inside Machinists Job Listings by Industry in the U.S. Gulf Coast



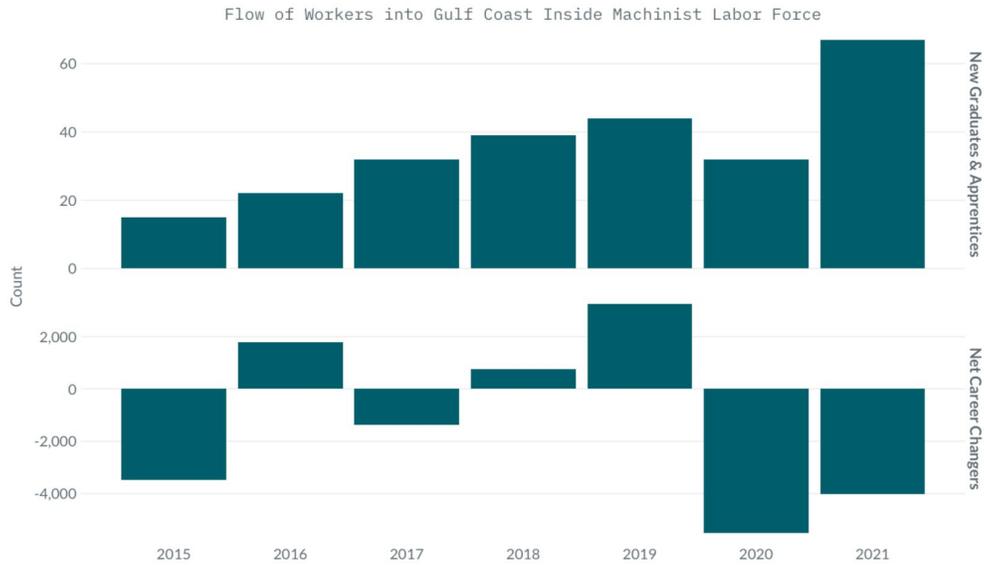


Figure 14. Flow of Workers into the Gulf Coast Inside Machinist Labor Force

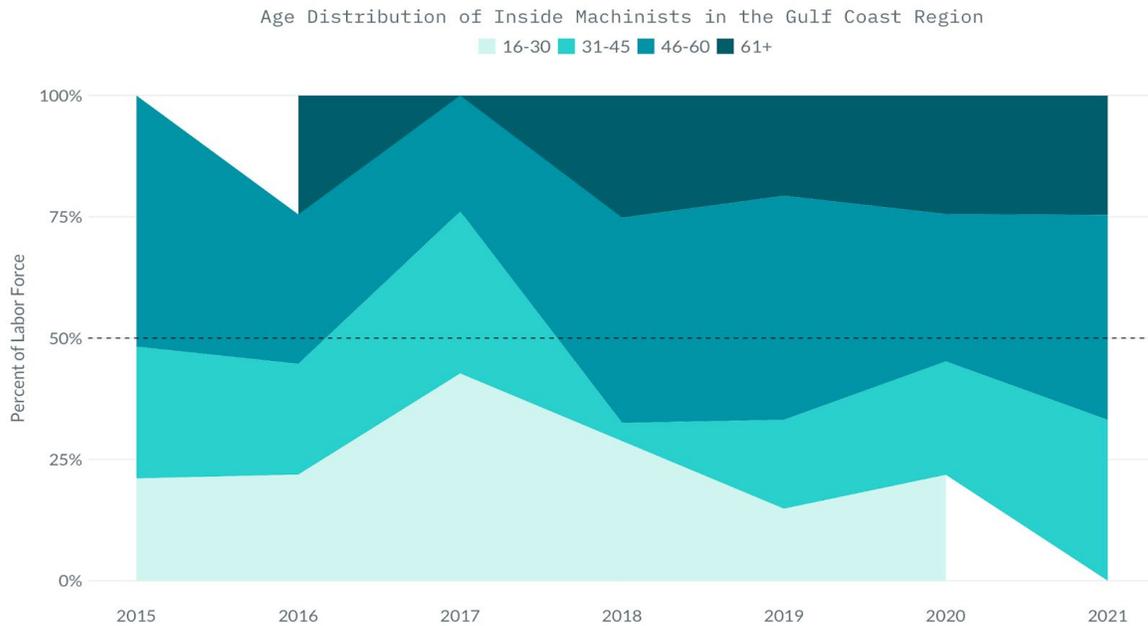


Figure 15. Age Distribution of Inside Machinists in the Gulf Coast Region

Labor Demand Proportions: Since 2019, the Navy has accounted for only a sixth of the demand for inside machinists in the Gulf Coast region. From 2015 to 2016, only 12% of the Gulf Coast inside machinist labor force was required for Navy shipbuilding, on average. The proportion of the labor force required grew dramatically to 34% from 2017 to 2018, corresponding to an increase in the Navy’s demand for shipbuilding during this time. Since 2018, demand for inside machinists has declined. On average, only 16% of the inside machinist labor force was required for Navy shipbuilding between 2019 and 2021. This indicates that the majority of inside machinists in the Gulf Coast region are engaged in work not affiliated with Navy shipbuilding



Industries Driving Demand: Vacancies for inside machinists in mining/oil and gas extraction surpass construction in 2018–2019. In 2015 and 2016, more than half of the job vacancies for inside machinists were in the manufacturing industry. Job vacancies across all industries in 2016 dropped 49% from 2015 levels and then increased at an average rate of 24% from 2016–2018, until dropping again slightly by 4% in 2019. From 2016–2019, job vacancies in manufacturing increased by 9% CAGR while vacancies in mining/oil and gas extraction increased by 66% CAGR.

New Entrants and Net Career Changers: Growth in machinist labor force from new graduates, and apprentices were offset by net career changers. From 2015–2021, the number of new inside machinist graduates and apprenticeship completers grew at 28% CAGR. Since 2019, 48 inside machinists, on average, enter the labor force from postsecondary institutions, including community colleges, as well as apprenticeship programs. However, this is complicated by the number of inside machinists leaving the trade for another profession. Since 2015, more workers changed careers *out of* the inside machinist trade than in the inside machinists’s trade, particularly in the past two years. On average, 1,200 inside machinists are lost every year due to career changers.

Age Distribution in the Labor Supply: An aging labor force of inside machinists poses the risk of mass retirement. Since 2015, a majority of workers have been over the age of 45, with the exception of 2016–2017, indicating that younger workers are not replacing older workers at the same rate. Of particular concern, the number of older workers is increasing while the number of younger workers is decreasing. Since 2018, 18% of inside machinists in the Gulf Coast region are 30 years or younger whereas 24% are 61 years or older. This increases the likelihood that waves of retirement will negatively affect the size of the inside machinist labor force in the coming years.

Metal Fabricators and Fitters

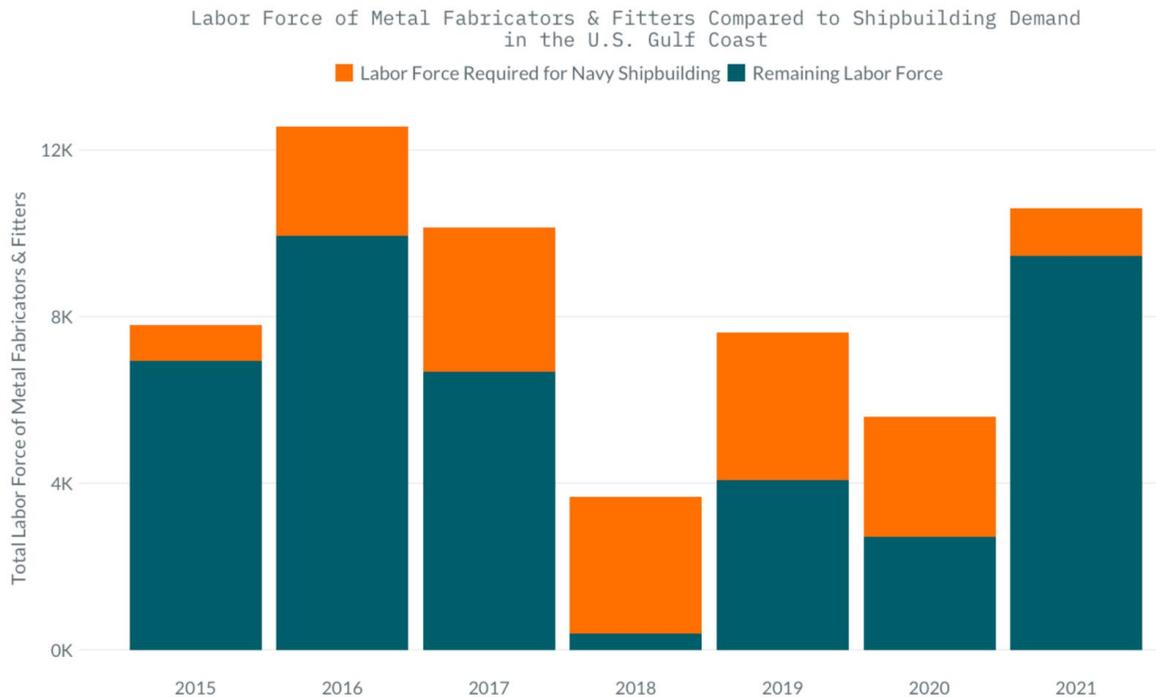


Figure 16. Labor Force of Metal Fabricators and Fitters Compared to Shipbuilding Demand in the U.S. Gulf Coast



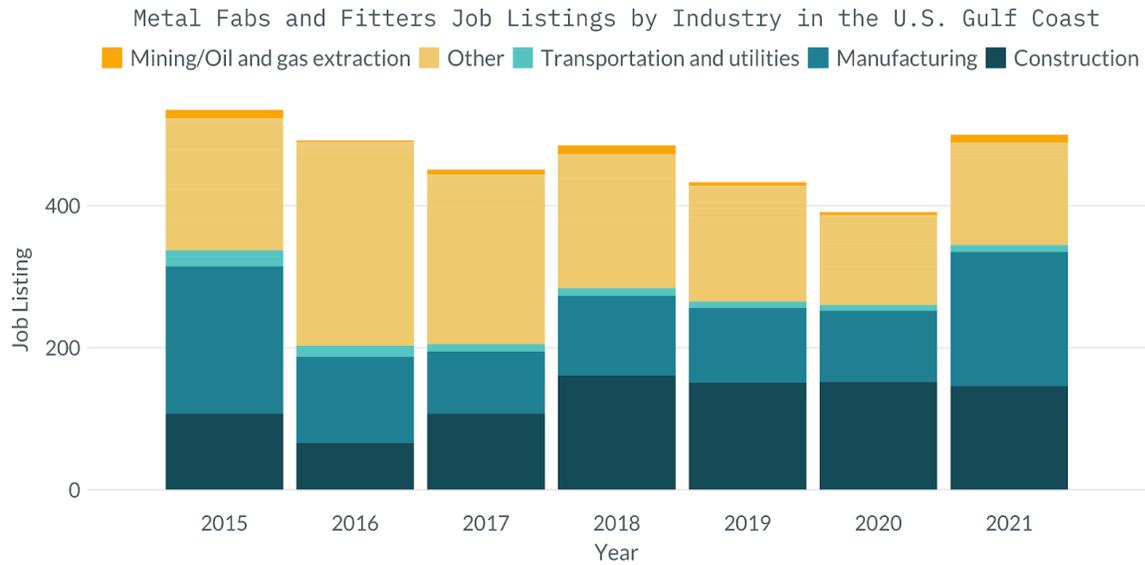


Figure 17. Metal Fabricators and Fitters Job Listings by Industry in the U.S. Gulf Coast

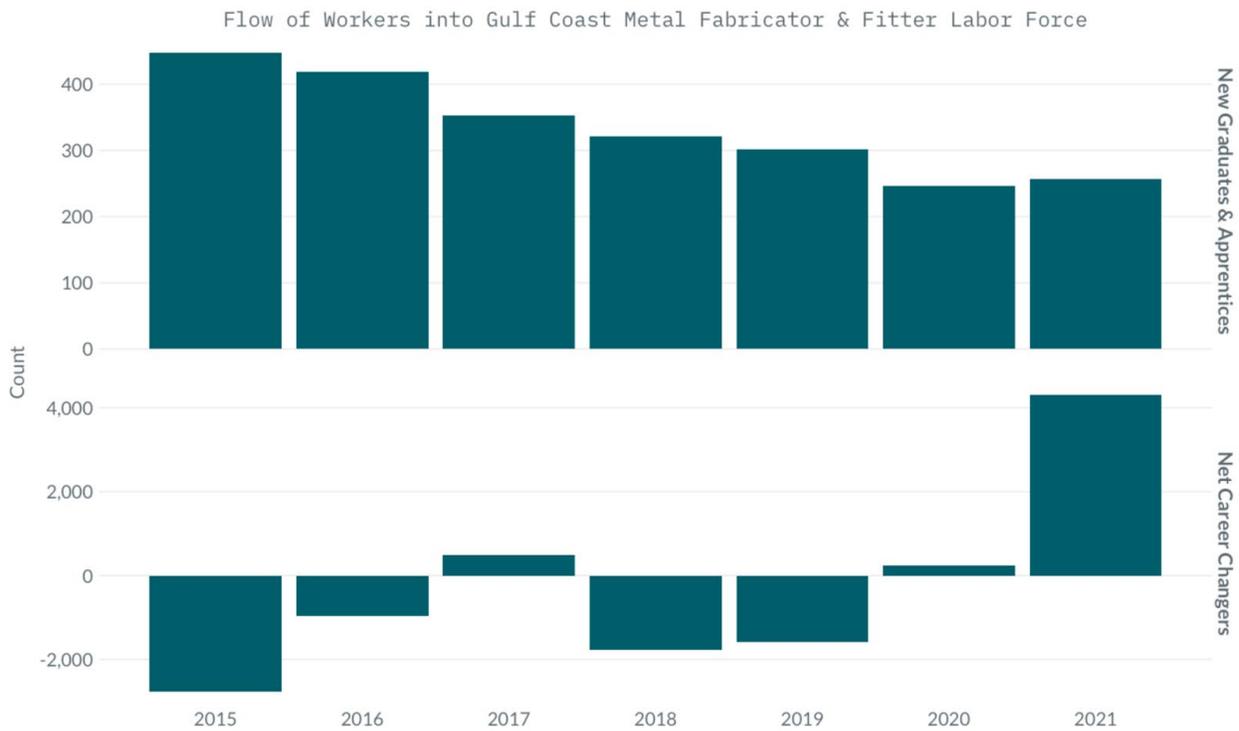


Figure 18. Flow of Workers into Gulf Coast Metal Fabricator and Fitter Labor Force



Age Distribution of Metal Fabricators & Fitters in the Gulf Coast Region

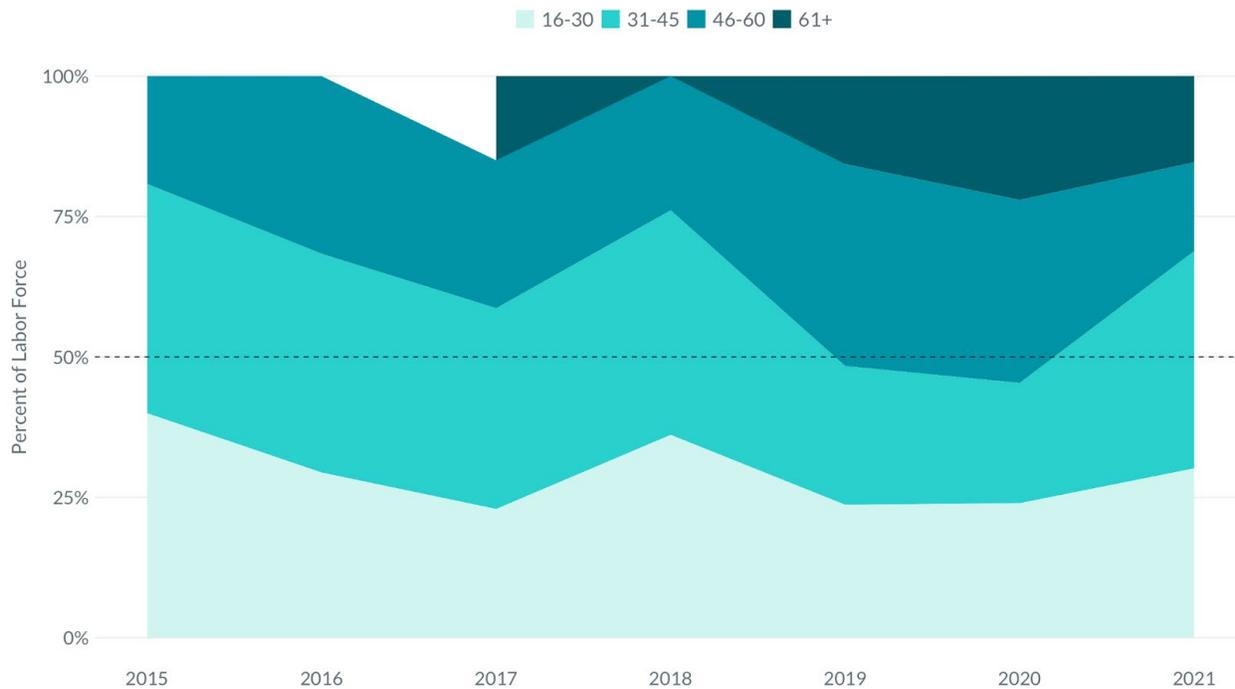


Figure 19. Age Distribution of Metal Fabricators and Fitters in the Gulf Coast Region

Labor Demand Proportions: U.S. Navy shipbuilding accounted for two-fifths of the demand for metal fabricators and fitters in the Gulf Coast region since 2015. But that proportion of demand has increased in recent years, rising 62% from 2018–2020.

Industries Driving Demand: At the same time, demand for metal fabricators and fitters vacancies have remained relatively stagnant in the last four years. From 2015–2017, job listings for metal fabricators and fitters gradually dropped by 6% CAGR. From 2017–2018, job vacancies in the manufacturing industry grew by 27% but then flattened out until 2020, before increasing by 89% in 2021. While vacancies in the manufacturing industry grew in 2021, demand in construction barely changed, even dropping slightly by 4%. Job vacancies in the construction industry dropped from a yearly proportion of 20% in 2015 to 13.41% in 2016, where it began to increase at an average rate of 6.37% year-over-year until 2020.

New Entrants and Net Career Changers: Recent years have seen a steady decline in metal fabricators and fitter graduates and apprentices. From 2015–2021, the number of new metal fabricator and fitters graduates and apprenticeship completers in the Gulf Coast region declined at 8.9% CAGR. Since 2019, on average, 268 metal fabricators and fitters entered the labor force from postsecondary institutions, including community colleges, as well as apprenticeship programs. Since 2015, more workers have changed careers *in* the trade than out, particularly in recent years. This net-positive change, however, was driven primarily by a massive spike in 2021 when 4,500 metal fabricators and fitters were added to the labor force from career changers.

Age Distribution in the Labor Supply: A recent influx of metal fabricators and fitters 45 or younger assuages concerns of an aging labor force. The age distribution of metal fabricators and fitters in the Gulf Coast region is generally stable and healthy, with a majority of workers aged 45 or younger every year except 2019 and 2020. In 2019–2020, the labor force for metal



fabricators and fitters was rapidly aging due to an influx of workers under the age of 46, particularly those aged 31–45 indicating that younger workers are generally replacing older workers at a consistent rate, which decreases the likelihood that waves of retirements will negatively affect the size of the labor force in the coming years.

Riggers

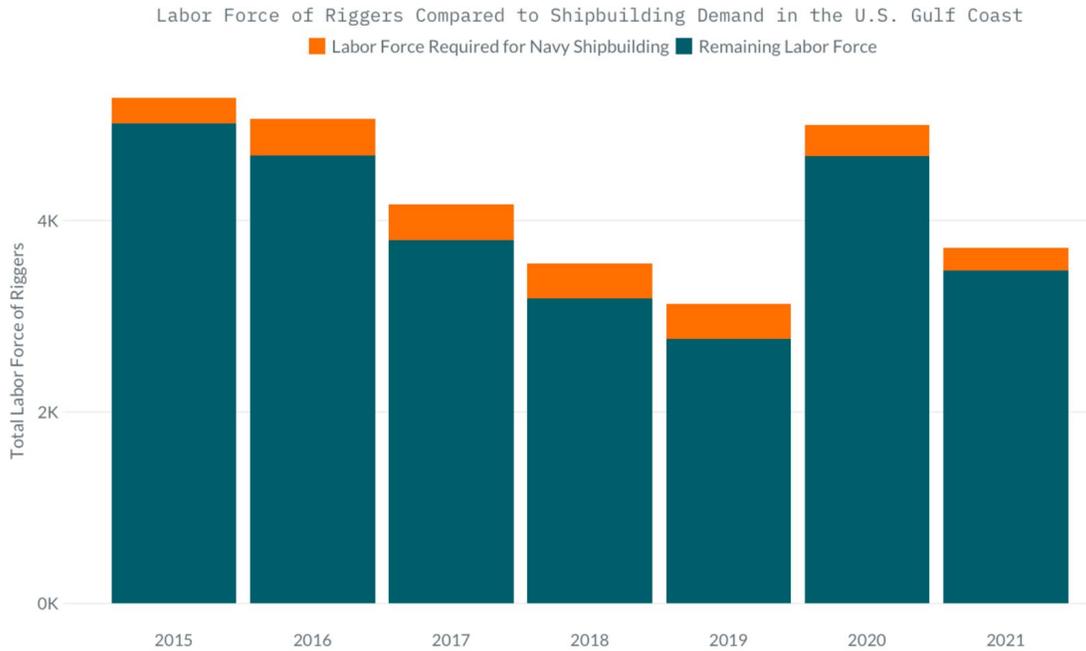


Figure 20. Labor Force of Riggers Compared to Shipbuilding Demand in the U.S. Gulf Coast

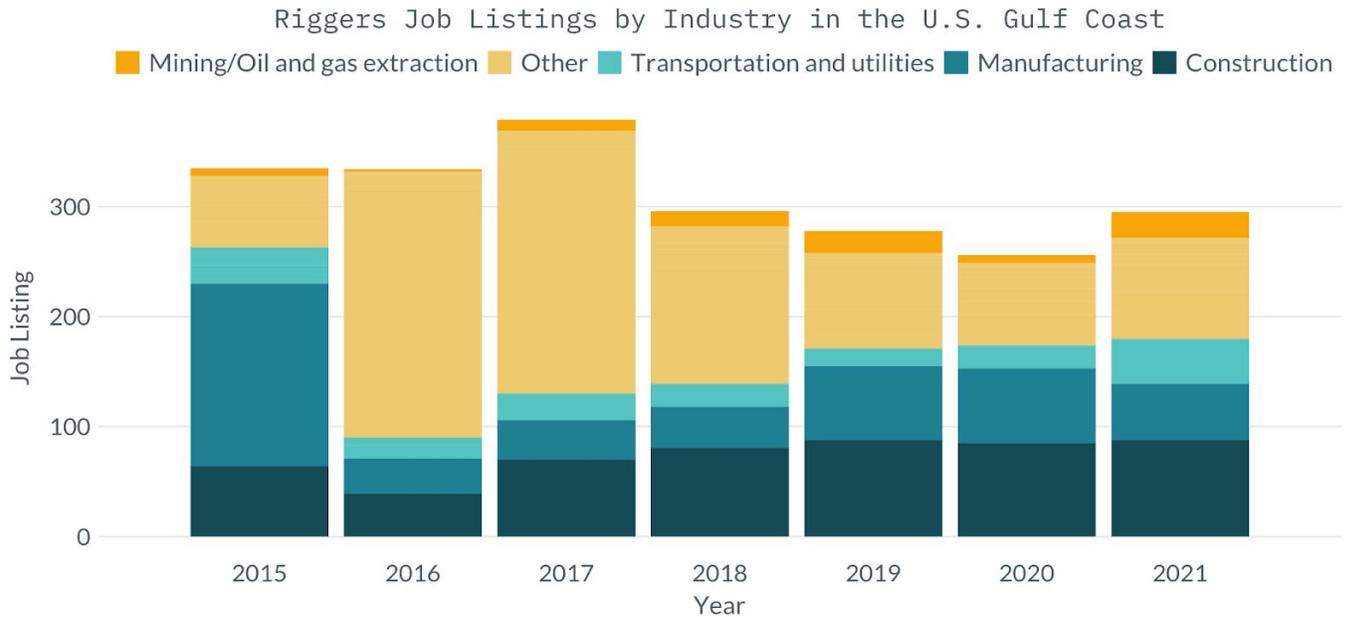


Figure 21. Riggers Job Listings by Industry in the U.S. Gulf Coast



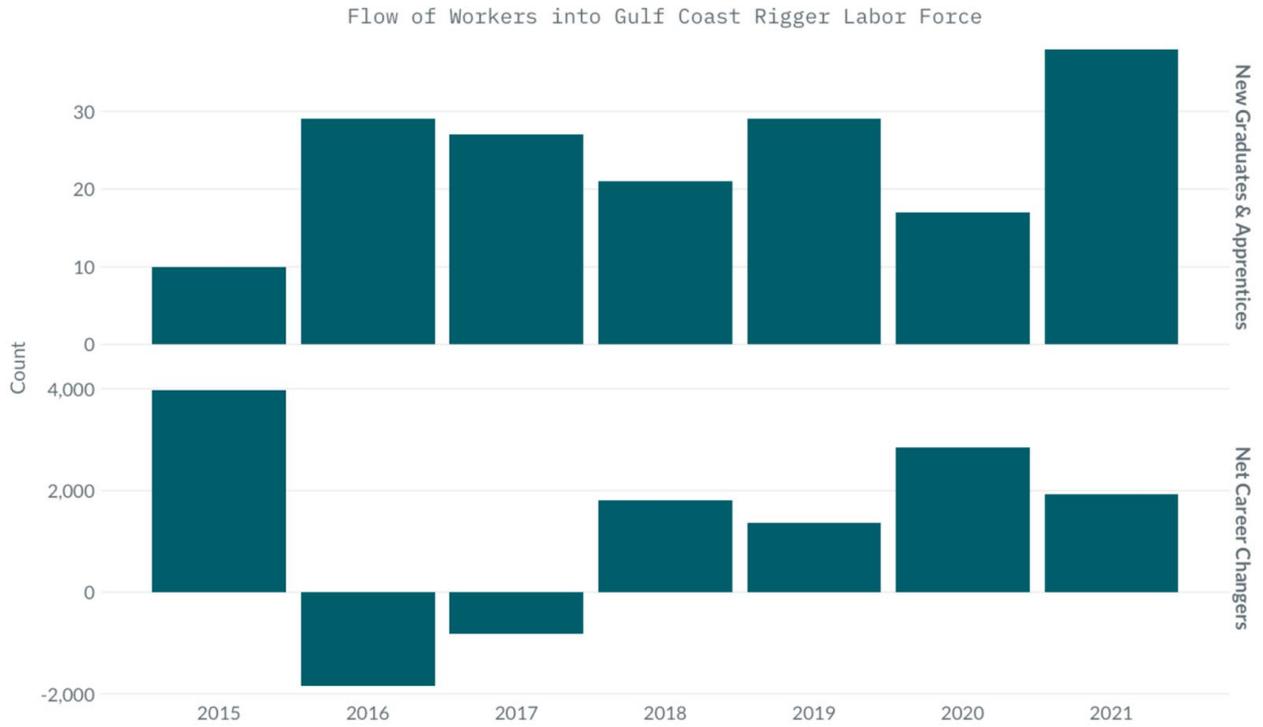


Figure 22. Flow of Workers into Gulf Coast Labor Force

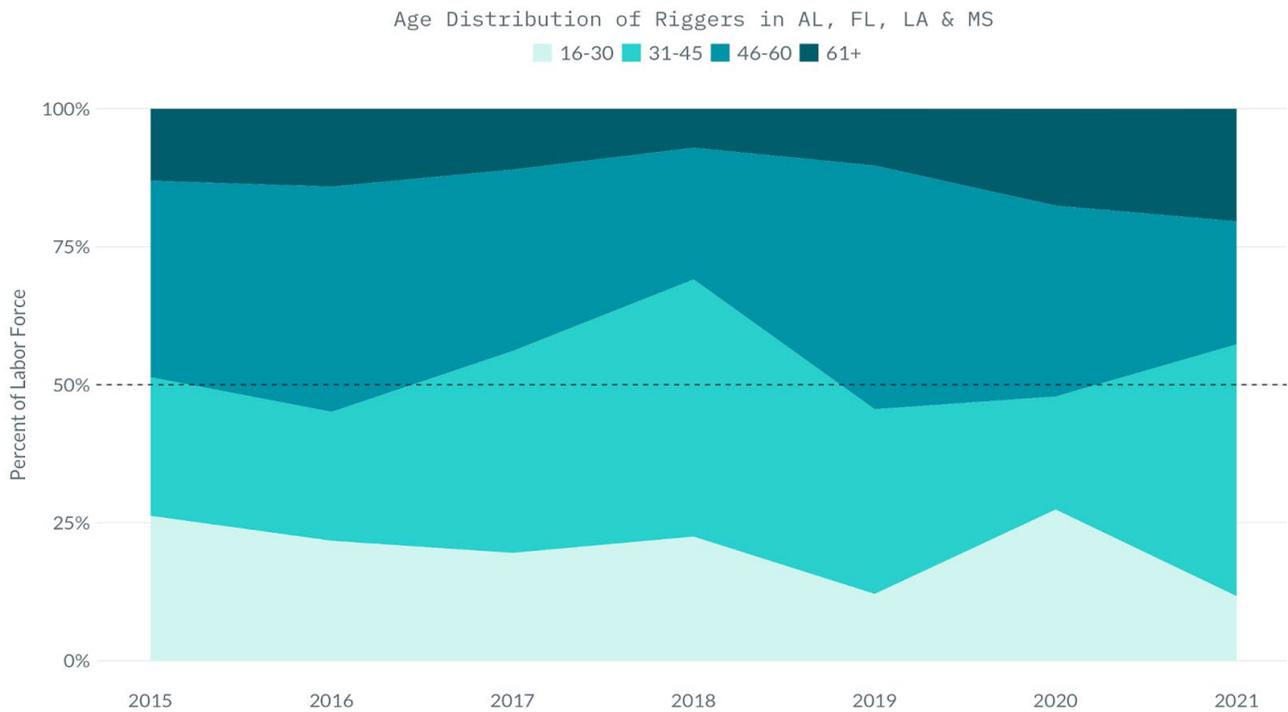


Figure 23. Age Distribution of Riggers in AL, FL, LA, and MS



Labor Demand Proportions: There has been a steady decrease in demand for riggers in Navy shipbuilding since 2015, with riggers working in Navy shipbuilding comprising a minority of the total labor force of riggers in the Gulf Coast region. At the same time, the proportion of the labor force required for Navy shipbuilding has been relatively stable, averaging around 8% of the total Gulf Coast rigger labor force between 2015 and 2021. Navy demand for riggers is consistent across years regardless of changes to the overall size of the rigger labor force.

Industries Driving Demand: From 2015 to 2016, job vacancies dropped by 81% in the manufacturing industry and 39% in the construction industry, while growing by 68% in the professional, scientific, and technical services industry. However, manufacturing and construction rebounded after 2016. From 2016–2019, job vacancies in the construction industry increased by 20% CAGR before flattening in 2019–2021 at an average of 62 job listings. Job vacancies in the manufacturing industry nearly doubled from 2018 to 2019 with an 81% increase in job listings but drops by 25% in 2020–2021.

New Entrants and Net Career Changers: The rigger labor force has been stabilized by a steady number of new graduates, apprentices and net career changers. From 2015 to 2021, the number of new rigger graduates and apprenticeship completers in the Gulf Coast region grew at 25% CAGR. On average, 24 riggers enter the labor force from postsecondary institutions, including community colleges, as well as apprenticeship programs. Moreover, more workers changed careers *in* the rigger trade than out of the rigger trade with an average of 1,300 riggers entering the labor force from career changers each year

Age Distribution in the Labor Supply: The age distribution of riggers in the Gulf Coast region shows a balanced labor force between older and younger workers. But the steady decline in the number of riggers 30 years or younger risks the ability to replace older generations of riggers. Starting in 2019, the number of riggers aged 61 or older grew from 7% to 21% of the overall labor force. The influx of workers aged 31–45, however, mitigates to some extent the risk that waves of retirements will negatively affect the size of the labor force in the coming years.





ACQUISITION RESEARCH PROGRAM
NAVAL POSTGRADUATE SCHOOL
555 DYER ROAD, INGERSOLL HALL
MONTEREY, CA 93943

WWW.ACQUISITIONRESEARCH.NET