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**U.S. NAVAL OFFICERS OF THE DECK: CONTINUING
ASSESSMENT OF THE MEASUREMENT AND
DETERMINANTS OF PROFICIENCY**

by

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**U.S. NAVAL OFFICERS OF THE DECK: CONTINUING ASSESSMENT
OF THE MEASUREMENT AND DETERMINANTS OF PROFICIENCY**

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ABSTRACT

This research is a continuing analysis of Officer of the Deck (OOD) proficiency in the U.S. Navy. Data was analyzed from the Surface Warfare Officers School (SWOS) OOD simulator assessments conducted with 66 OODs in Newport, Rhode Island, from April 2019 to January 2020. Additionally, self-reported demographic and experience survey data was used, which was categorized into demographics, operational tempo, overall experience, and the recency of that experience. Summarizing the experience data, the author observed over 60% of an OOD's time in the first tour is spent inport and total simulator hours are relatively low. The findings suggest that increasing simulator training during non-underway periods may be an area for improvement. Estimated multivariate regression models were used to determine if OOD performance is correlated with experience and recency of that experience. Several key variables are correlated with proficiency, but a low sample size prevents a conclusion that these relationships are statistically significant. Ultimately, continued research is needed to more accurately assess OOD performance factors, analyze long-term policy effects, and provide input into future policy making.

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LIST OF ACRONYMS AND ABBREVIATIONS

ADOC	Advanced Division Officer School
AIS	Automatic Identification System
AMPHIB	Amphibious
BDOC	Basic Division Officer School
BRM	Bridge Resource Management
CG	Guided-Missile Cruiser
CIC	Combat Information Center
CO	Commanding Officer
COMNAVSURFOR	Commander Naval Surface Force
COMNAVSURFPAC	Commander Naval Surface Force U.S. Pacific Fleet
COMNSURFLANT	Command Naval Surface Force U.S. Atlantic Fleet
CONN	Conning Officer
COVE	Conning Officer Virtual Environment
CRUDES	Cruisers and Destroyers
CVM	Nuclear Aircraft Carrier
DDG	Guided-Missile Destroyers
DoD	Department of Defense
GAO	U.S. Government Accountability Office
JOOD	Junior Officer of the Deck
LCC	Amphibious Command Ship
LCS	Littoral Combat Ship
LHA	Landing Helicopter Assault
LHD	Landing Helicopter Dock
LPD	Landing Platform Dock
LSD	Landing Ship Dock
MCM	Mine Counter Measure
NSS	Naval Seamanship and Ship-handling
NSST	Naval Seamanship and Ship-handling Trainer
NUC	Not under command
OCS	Officer Candidate School

OJT	On the job training
OOD	Officer of the Deck
PC	Patrol craft
RoR	Rules of the Road
ROTC	Reserve Officer Training Corps
SWO	Surface Warfare Officer
SWOS	Surface Warfare Officer School
TSS	Traffic Separation Scheme
UNREP	Underway Replenishment
USFF	U.S. Fleet Forces
USMMA	U.S. Merchant Marine Academy
USNA	U.S. Naval Academy
VMS	Voyage Management System

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I. INTRODUCTION

In summer 2017, the United States Naval Surface Force (7th Fleet) suffered two major collisions within a short timeframe. The USS *Fitzgerald* and USS *McCain*, both from 7th Fleet, experienced separate incidents at sea with commercial transport ships resulting in severe ship damage and the deaths of 17 Sailors. These collisions sent shockwaves through the Navy and resulted in a public call for a complete and thorough investigation to review what led to two separate highly capable warships catastrophically collide during routine operations at sea. The collisions resulted in various investigation reports and policy changes to Surface Warfare Officer (SWO) community training, operations and Officer of the Deck assessments.

A. ASSESSMENT OVERVIEW AND METHODOLOGY

This research is a continuation of the Officer of the Deck (OOD) assessment pilot study analyzed previously by Dr. Jesse Cunha and LT Robb Dearth and the pilot study is referred to in the paper for comparison. We analyzed 66 assessments that were conducted between April 2019 to January 2020 in seven different assessment periods. In this paper, our research is referred to as 2019 assessments and the assessments conducted in 2018 is referred to as the pilot study.

The current OOD proficiency assessments are conducted in Newport, Rhode Island by the Surface Warfare Officer School (SWOS). Data collected is in the form of an assessment grade sheet, survey questionnaire and a Rules of the Road (RoR) and Navigation Seamanship and Shiphandling (NSS) exam scores. We combined all data observations from the seven assessment periods and utilized statistical analysis software to determine summary data and regression analysis. Our results show the sample is a representative distribution of the fleet population in terms of homeport, ship class, ship type, and commissioning source.

B. ASSESSMENT FINDINGS

The OODs assessed in our research served onboard their ship while policy changes were being implemented, and therefore, have not received the increased training now required. However, based on current assessments, we found the assessment overall grade performance to be 6% unsatisfactorily, 14% marginal, 23% below average, 32% average, 12% above average, 12% excellent and 2% exceptional on the 1-7 grading scale (Table 13). When compared to the pilot study's 3 category grades, we find that the overall performance is nearly identical. Although a direct comparison is not possible since the pilot study analyzed a different population, it still allows for some trend analysis.¹ Furthermore, the RoR exam has a 69.7% pass rate and a 42.4% pass rate for the NSS exam administered by SWOS. We observe an operational tempo of 64% (17.8 months of an average 27.8-month first tour) either in-port or in the shipyard. While the average underway experience as an OOD was 252 hours, only 30 hours occurred in the simulator. With the first tour length shifting to a longer 30-month tour, in addition to the increased simulator and formalized OOD training, we expect OODs to have more operational experience in the future.

Additionally, we conducted statistical regression analysis to determine the factors that are associated with OOD proficiency. We find that if an officer passes the decision-making subcategory or the performance-under-stress subcategory on the proficiency assessment they are more likely to pass the competency assessment. We also see that officers above the median experience of OOD hours underway are more likely to have a higher assessment score. There is a statistically significant relationship between an officer above the median number of straits transits conducted and passing the competency as well as the total evolutions (sum of all evolutions) and assessment score. Recency analysis is based on having any hours or no recent experience due to the low mean and median values of the continuous variables. We see a relationship between having any number of hours as OOD, underway or in a simulator, and assessment score as well as any evolutions in the

¹ The pilot study was a fleet spot check of OOD performance with varying timeframes of an officer's first tour. The current research is of officers who have completed their first division officer tour.

past 90 days. Although there is some correlation, we cannot confidently state the significance or magnitude of the relationships due to the high significant errors which are driven by the low number of observations.

C. SUMMARY OF RECOMMENDATIONS

We propose the following recommendations to improve survey quality are proposed:

1. Improve assessment survey.
2. Update the assessment grade sheet to minimize subjectivity.
3. Implement an electronic collection format for Surface Warfare Mariner Skills Logbook in addition to the current paper version.
4. Continue OOD assessment research and expand its use to other SWO assessment timeframes.
5. Increase simulator training, specifically leveraging simulators during in-port, maintenance and shipyard periods.

Shifting to an electronic survey format reduces the possibility of errors occurring from data collection, while also providing a more efficient method of analysis. A focus should be to improve the overall grading scale, while not changing its core measurement abilities. In the overall performance, 1-7 grading scale, there is a significant level of subjectivity of what differentiates grades like an exceptional versus excellent score. Adjusting to a 1-5 grading scale and associating a Commanding Officer's expectations of each grade would greatly reduce the subjectivity. For example, a grade of 1-unsatisfactory could be associated with an officer the Captain does not trust and would not qualify. A grade of 2-below average could be considered probationary and only fit for daytime watchstanding, while 3-average and above is an officer the Captain trusts to stand watch at all hours. High performing officers who score 4-above average and 5-excellent are those that could be selected to train prospective OODs.

Research of an electronic survey format and database must begin now to coincide with the Surface Warfare Mariner Skills Logbook. We understand that many changes occurred since the collisions and it will take time for those policy effects to be reflected in OOD performance assessments. However, research and development must begin on the next phase of the logbook, and we believe that the next phase is the database and software development. Creating a database for tracking of watchstanding experience would reflect what other programs are currently using, both inside the Navy and in the civilian sector.

Our final recommendations are to expand this assessment and its observations to the other evaluation periods in a SWO career. This will allow trend analysis as well as statistical regression analysis with tighter confidence intervals on the factors that affect an OOD's performance. Expanding to other assessment periods may also allow for SWOS to track progression of a SWO throughout their career. Additionally, based on research summary findings, we recommend future research into fleet simulator usage, and increasing the use of simulators during inport and shipyard periods. The OOD's assessed in this research were Ensigns when the collisions occurred, and when policy changes were published. Therefore, the effects of policy changes' are not fully implemented in our population group and we expect experience mean values to increase in future research. When combined with our work future research can provide a more complete trend analysis, giving the Navy metrics on OOD performance trends and the impacts of the increased formalized training.

II. BACKGROUND

The chapter describes the Surface Warfare Officer community background, theory, and current literature on the use of naval simulation training in the Navy. Additionally, we will look at the research on the performance effectiveness of simulation-based training.

A. SURFACE WARFARE COMMUNITY BACKGROUND

1. Comprehensive Review of Recent Surface Force Incidents

On October 26, 2017, U.S. Fleet Forces Command (USFF) published their findings of the directed investigation into the contributing factors that led to the separate accidents involving the USS *Fitzgerald* and USS *McCain* (USFF, 2017). Additionally, USFF analyzed past naval incidents to determine a trend of causal factors of concern within the surface force. The determined contributing factors included:

non-compliance with safe navigational practices, incorrect action in extremis, substandard proficiency of bridge and Combat Information Center (CIC) watchstanders, substandard risk management and planning, substandard bridge and CIC coordination, substandard CIC performance, inadequate use and understanding of technology, practice of not using AIS, substandard use of lookouts, watch bill execution, poor log keeping, ineffective shipboard training programs, and inadequate fatigue management. (p. 35-39)

They further categorize the causal factors under the areas of operational safety, assessment, fundamentals, teamwork, and culture. It was these areas that USFF recommended needed improvements and it specifically addresses Surface Warfare Officer training, assessment and culture as areas requiring attention to resolve deficiencies.

As training is a major focus for the SWO community the USFF findings are significant, directly stating, “Surface Warfare Officer candidate training is too dependent upon on the job training (OJT)” (USFF, 2017). Additionally, they found a lack of assessments conducted on SWOs throughout their careers and specifically a lack of standardized training. Each ship has different standards and those standards vary depending on which ship an officer is assigned to. USFF specifically states that there is a lack of refresher training on Nautical Rules and Bridge Resource Management (BRM) at each

career milestone while also lacking an effective assessment. They also determined the SWO community lacked tools to track sailor experience, including time spent as a watchstander and time spent at sea conducting operations (USFF, 2017). In response to the USFF Comprehensive Review, various policy changes were made and implemented to address the identified deficiencies, as outlined below.

2. SWO Career Path Changes

In June 2018, Commander Naval Surface Force (COMNAVSURFOR) issued a directive, “Surface Warfare Officer Career Path and Training Continuum” outlining the changes to the SWO community career timelines (Commander Naval Surface Forces [COMNAVSURFOR], 2018a). Updated junior officer career timeline and milestones are as follows:

a. Junior Officer Training

- Ensigns will attend two training courses, Basic Division Officer School (BDOC) and OOD Phase I prior to reporting to their ship. Previously only BDOC was attended and not OOD Phase I.
- OOD Phase II to be attended upon completion of first tour or prior to fleetting up on the same ship.
- Advanced Division Officer Course (ADOC) to be attended upon successful completion of OOD Phase II. OOD Phase II is new and previously only ADOC was attended between ship tours.

b. Tour Changes

- First Division Officer tour is extended from 24 months to 30 months. Option for single long tour of 48 months instead of two separate tours.
- Second Division Officer tour reduced from 24 months to 18 months.
- Second Division Officer tour can no longer be served at afloat staff.

- Afloat staff tours will now be conducted by a post-division officer.
- Afloat Department Head staff tours will now be conducted by post-Department Head officer.
- Time between Department Head and Executive Officer tour will be reduced from 5.3 to 4.5 years.

c. Assessments

- Ten career assessments have been implemented throughout the SWO career path and at career milestones. (COMNAVSURFOR, 2018a)

Additionally, among COMNAVSURFOR's career path changes is an emphasis on the use of simulation-based training (COMNAVSURFOR, 2018a). Also, the instruction specifically states an Ensign will receive more than 100 hours of simulator training as part of the OOD Phase I course which is due to be fully functional by 2021.

d. Mariners Skill Logbook

To track SWO experience, COMNAVSURFOR established the Mariner Skill Logbook. The logbook is split into three major experience types: watchstanding log, special evolution, simulator training (COMNAVSURFOR, 2019). The logbook is a significant change for the community with the intent of allowing better tracking of experience and proficiency, allows future analysis and builds a professional mindset for the community. The goals of the logbook book are accomplished through the tracking of the major experience categories by the watchstander, quarterly verifications (Figure 1) and an end of tour summary letter of experience (Appendix A).

Commanding Officer Quarterly Endorsement Page	
I certify completion of <u>150</u> Underway hours, <u>10</u> Simulator hours, <u>3</u> Sea and Anchor Detail, <u>5</u> Replenishment at Sea, <u>2</u> Anchoring Evolutions, and <u>1</u> Straits Transits during the period from <u>01 Jan 2018</u> to <u>31 Mar 2018</u> .	
<div style="display: flex; justify-content: center; align-items: center;"> <div style="border-bottom: 1px solid black; width: 100px; margin-right: 5px;"></div> //Signed// </div>	
Commanding Officer	
Comments: <i>Qualified OOD 15 January</i> <i>OOD for Night RAS 10 February</i> <i>OOD SOH transit 14 February</i> <i>Officer needs to focus on division of labor among bridge watch team</i>	

Figure 1. Mariners Skill Logbook Quarterly Endorsement.
Source: COMNAVSURFOR (2019).

3. Proficiency Requirements

On November 13, 2018, COMNAVSURFOR released his instruction that provides direction on minimum watchstander proficiency requirements and requalification standards. Requirements by watch station are as follows (Commander Naval Surface Forces (Commander Naval Surface Forces [COMNAVSURFOR], 2018b):

- Officer of the Deck, Tactical Action Officer and Combat Information Center Watch Officer - 1 watch every 45 days.
- Junior Officer of the Deck and Conning Officer - Not applicable.
- Engineering Officer of the Watch and Combat Systems Officer of the Watch- 1 watch every 30 days. (p. 1-3, Enclosure 1)

Additionally, if proficiency is not maintained watch standing proficiency refresh requirements typically involve conducting the watch station under supervision (under instruction) of a proficient watchstander or a higher positioned person. COMNAVSURFOR approves maintenance of proficiency either underway or in port, utilizing a simulator. Results will be logged utilizing the newly implemented Surface Warfare Mariners Skills Log Book, and also tracked by the Senior Watch Officer onboard ship.

4. Circadian Rhythm Fatigue Management

In 2017, Commanders of U.S. Pacific and Atlantic fleet both issued their joint instruction COMNAVSURPAC/COMNAVSURFLANT INST 3120.2 Comprehensive Fatigue and Endurance Management Policy (Commander Naval Surface Force U.S. Pacific Fleet [COMNAVSURPAC], 2017). In the Surface Force, the review addressed fatigue (and the culture that surrounds it) as a contributing factor in the 2017 collisions and the culture that surrounds it. The instruction directs units to use the circadian rhythm-based routine into the unit in order to minimize sub-optimal alertness as a result of fatigue, by implementing fixed watches and protected sleep periods. The instruction goes on to specify the minimum amount of sleep required: either an uninterrupted 7-hour period or a 5-hour period with a 2-hour nap.

5. Surface Warfare Officer Career Manual

On December 16, 2019, COMNAVSURFOR issued his newest instruction titled, Surface Warfare Officer Career Manual. It cancelled 5 instructions, including 2 instructions previously discussed with the intention to create a one-stop instruction for community instructions and directives (COMNAVSURFOR, 2019). Its purpose, “to establish the single SWO community governing document, providing the requirement and milestones from accession through major command” (p. 1). Additionally, it is split into 5 chapters, “watchstander proficiency requirements, mariner skills logbook requirements, SWO qualification and authority to wear the insignia, SWO milestone mariner skills assessments evaluations and competency checks and surface force command requirements” (p. 3-4).

With a review of the document, there were no major changes and that the full intent was as stated in the purpose. From experience, this is welcomed and a significant change for career planning and SWO community operations. To cancel 5 instructions and combine them into a single document eases the administrative burden on the community and eases the task of remaining up to date on the current instruction revision by only having to reference the single document vice multiple.

B. LITERATURE REVIEW

1. Naval Simulator Theory

Since the early 2000s, research has extensively analyzed the current state of the Navy's use of simulators and recommended changes to better utilize simulation-based training. For example, RAND National Defense Research Institute conducted a study on the use of simulated training by the U.S. Navy in 2005 focused on "assessing the potential of reduction or augmenting underway training by completing more training exercises through simulation" (Yardley, Thie, Schank, Galegher, & Riposo 2005). Although some of the policies have varied since the study was conducted, it provides great insight into the analysis conducted on the viability of simulator training. Yardley et al. (2005) determined that training representatives for the U.S. Navy were concerned that increasing the use of simulators for training would result in a reduction of competency. The preferred training method and instilled culture was underway training being the best method of learning for SWOs.

The recommendations from Yardley et al. (2005) for the naval service simulation training are summarized as follows: "clearly define the goals of training, specify measures of effectiveness for training, utilize multiple approaches to reduce underway training, and develop an investment strategy into quality simulators. Additionally, they recommend developing a simulation strategy that clarifies and determines what simulators can be used for as an equivalent for training and proficiency" (p. 55-62). Yardley et al. (2005) ultimately determined that the Navy was conducting most exercises underway, even when there was an approved in-port equivalency. They also determined that an underway on the job training culture was one of the significant obstacles for expanded simulator use. Based on personal experience, this job training culture persists when it comes to Navy fleet best training practices. However, that may be shifting as the simulator training initiative has been prioritized since the collisions of USS *McCain* and USS *Fitzgerald*. A clear and focused training strategy and investment into quality simulations is imperative for their continued effective adoption.

Similarly, in 2002, Schank, Thie, Graff II, Beel, and Sollinger (2002) conducted an analysis of the naval services current tactical training and the use of simulators compared to our allies' practices and other branches within the Department of Defense (DoD). They examined three areas for training: the F/A-18, the P-3C, and the DDG-51 class, in addition to other services and allies (Schank et al., 2002). They found that simulator training did not have a large role in the F/A-18 training model but was significant in the P-3C and DDG-51 training when it came to Anti-Submarine Warfare training. The recommendations in Schank et al. (2002) are similar to those of Yardley et al. (2005) in that the Navy needs additional measures to gauge readiness and to establish a goal for future live and simulator training. Essentially the Navy must analyze simulators, if they are to have a greater return on investment than live training.

2. Simulator Training Effectiveness

From a different perspective, Weaver (2013) conducted thesis research on student examination performance with simulator use during Rules of the Road (RoR) training compared to students who only received classroom training. To compare, Weaver analyzed 27 volunteers who used simulators and 341 participants who only received the classroom training. For his research, the control group was the 341 participants whose results were provided by the Surface Warfare Officers School and a pre-RoR and post-RoR exam was conducted on the treatment/experimental group of 27 between and the pilot study and experimental group (Weaver, 2013).

Weaver's results showed a statistically significant higher difference in the RoR exam scores of the treatment group when compared to the control group of students. He showed the pilot study of 6 students mean scores increased from approximately 77% to 93% and the experiment group of 21, increased from 85% to 98%. In comparison 97.94% of students scored below 90% after their courses of instruction in the control group utilized (Weaver, 2013). While his results speak to the benefits of simulator training, the estimates may be biased because the treatment group were self-selected volunteers who may have had a higher aptitude for succeeding in the training. Future research in this field would

benefit from the use of randomized controlled trials, instead of voluntary participation of the treatment group.

Additionally, in 2012, Reber and Bernard reviewed the performance of a Surface Warfare Officer Instructor course on students when utilizing a simulator-based training as opposed to students who did not prior to the use of the Conning Officer Virtual Environment (COVE) simulator. From experience, COVE is a specific type of simulator that utilizes a headset that the operator wears and uses voice commands to control a ship in the simulated environment. They hypothesized that the experimental group would perform at a higher level or at an equal level of the control group in various graded categories (Reber & Bernard, 2012). Reber and Bernard's experiment included a total of 21 participants, with 11 students in the treatment group and 10 students in the control group. They concluded that students who used the semi-immersive game prior to performing in the SWOS instructor led COVE, performed at a higher and more proficient level than the control group. Additionally, they conducted an end of experiment survey and the students believed that the game helped them prepare better for the COVE simulator exercise. Like Weaver's ROR research, Reber & Bernard's treatment group were volunteers, which exposes the research to potential self-selection bias and is therefore, a consideration when reviewing the results of the COVE assessment. The small sample size is also problematic as a stronger experimental model would include a larger sample size and randomly selected participants, to minimize the potential for biases.

Additionally, Tsoukalas, Papachristos, Stefanakou, Tsoumas, and Nikitakos (2014) assessed simulator-based training in the Athens Merchant Maritime Academy, intending to evaluate the effectiveness of the use of simulation of marine engines. Their study surveyed 116 participants (Tsoukalas et al., 2014), and their method was broken into two areas; focusing on the course structure and technical aspects for clarity of research. The results were that the students' perceived the courses as adequate and were pleased with the simulators for learning (Tsoukalas et al., 2014). The conclusion of the research was that overall students are satisfied with the simulator instruction for training but that there are areas of improvement in increasing simulator study time and their problem-solving teaching design to improve learning efficiencies (Tsoukalas et al., 2014). This research,

although focused specifically on the use of simulator training at the Athens Merchant Maritime Academy, is applicable to simulator-based training and evaluation methods in all areas: a simulator-based training mechanism is only as good as the performance results and the perception from the students. However, investment into a simulator training system may not be returned. Restructuring is needed, if there is no sign of increase in performance and/or if student's feel the training is inadequate. This same methodology can be applied to SWOSs simulator-based training and evaluation, and must be considered when reviewing their training curriculum and goals.

Sonu, Liu, Louis, and Dascalu (2019) conducted another supporting study as part of the 2019 International Conference of Information Technology. They specifically presented research on the effectiveness of pairing simulator training with learning RoR and the way active learning is more effective than passive learning. The authors created a ship simulator where they could compare the effects that simulation-based learning would have on student learning compared to a traditional method. Their simulator allowed students to visually learn RoR and actively control ships' maneuvering positions. The Sonu et al. (2019) study involved 44 students split into equal parts control and experimental group where both groups were given pre- and post-tests. Their control group utilized internet RoR study material and the experimental, utilized the RoR simulator for self-study. Sonu et al. (2019) found that students who utilized RoR simulation-based learning did significantly better than students who only used traditional learning methods, with a 20% mean score improvement on the post-test. They also found that the students who utilized the simulator found it effective and a moderate level of difficulty compared to the control group who found the traditional method of learning difficult to learn navigation concepts.

The Sonu et al. (2019) study shows that use of simulation-based training for learning complex material like RoR has a meaningful positive impact on student performance. This study supports the notation that the Navy should continue exploring the best methods of implementing simulation-based training for learning and proficiency. Interestingly, while they found that 70% of students thought the simulation training method beneficial, 22% did not, which highlights the fact that every student has a different optimal learning style. The authors add to supporting research into the use of simulator's for

seagoing services like the Navy and the Coast Guard when teaching students these complex rules and information. Sonu et al. adds to the simulation learning in an area that is particularly important to the SWO community, which is learning and applying RoR, while other research papers have explored the impact of simulation learning as a general concept.

Although their study appears to minimize the potential for certain biases to affect their findings, a proposal to better improve the study is to utilize a larger sample size for future analysis. This will reduce the likelihood that their findings were an abnormality from the small sample size. To solve this would be to use a mixed learning method approach of both classroom and simulation training combined. Our research will add to their area of research and focus on the variables that affect an OOD's performance and proficiency, which directly uses RoR in the simulator scenarios conducted at SWOS.

3. U.S. Government Accountability Office Report

Two years following the Navy's comprehensive review, in November 2019 the U.S. Government Accountability Office (GAO) published their report evaluating the changes made by the Surface Warfare community. The stated purpose, "(1) describe the changes to the Navy has made or planned to make to the SWO ship-driving training since the 2017 collisions and (2) assess the extent to which the Navy has taken actions to evaluate the effectiveness of those changes" (U.S. Government Accountability Office [GAO], 2019, p. 2). GAO determined the effectiveness of changes by conducting interviews, in addition to reviewing instructions and administrative changes. GAO also discussed the changes supported by an increase in simulator training, specifically "by 2021 plans to triple the number of ship-driving training hours when compared with the amount of training SWOs were required to receive prior to the collisions" (p. 10). They determined that when the Navy officially establishes the four Junior Officer training courses (BDOC, ADOC, OOD Phase I and OOD Phase II) the number of hours required will increase from 174 hours to 535 hours of training (GAO, 2019).

GAO (2019) has also found the Navy lacks assessment capabilities of policy changes that have occurred in the Surface community since the collisions. They state the following regarding the Navy's actions:

Specifically, and described in detail below, in planning an approach for evaluating its efforts, the Navy has not (1) solicited fleet-wide feedback on the quality of increased ship-driving training, (2) planned to routinely conduct ship driving competency assessments, (3) provided standard criteria for qualifying Officer of the Deck candidates, and (4) determined how to analyze and use information from logbooks that SWOs are required to complete. (GAO, 2019, p. 16)

Another startling find was that in an OOD assessment spot check conducted January to March 2018 of 164 SWOs, 84% had concerns, with 18% reporting significant concerns (GAO, 2019). They also found that the required Surface Warfare Mariner Skills Logbook lacked any, “specific, measurable plans to analyze and use these data or to assess the completeness of these data” (p. 27). GAO (2019) ultimately made four recommendations to the Navy summarized as implementing a feedback mechanism from the fleet, conducting regular OOD assessments, SWOS establishing standardized OOD criteria, and establishing an analysis method for the Mariner Skills Logbook data.

The GAO report highlights important concerns as a result of the instructions and training programs implemented after the collisions. The first step in changing the training culture in the community is to establish the new policies, and the next step is to close the loop on evaluation of effectiveness and the recommendations GAO proposals are appropriately needed for the SWO community to take the next step. A point of concern is that the previous research from the early 2000’s states these same concerns with Navy simulator training as stated above. If the Navy does not address these concerns and questions then there is the possibility that they will go down the wrong path and not use resources effectively. Our research is intended to evaluate and improve the OOD assessments conducted at SWOS that are used as a type of spot check, as not every student conducts the assessments in our dataset. With this research, we can continue to improve the data collection methods used to improve the quality of data to allow accurate analysis of factors that determine OOD proficiency.

4. OOD Pilot Study Assessment

Cunha and Dearth (2019) published a technical report on research evaluating the SWOS OOD Assessment Pilot Study conducted on 164 OODs in 2018.² Their research intent was to evaluate the data collected, evaluate the quality of data and improve processes by SWOS for future data collection. The research results provided the first empirical estimates of the relationship between proficiency and knowledge, skills, experience and currency (Cunha & Dearth, 2019). Although they did find factors such as experience, skills and knowledge can be indicators of proficiency, issues identified in the pilot study data resulted in analysis limitations.

Cunha and Dearth identified limitations on the data collected in 2018 as not having a variable that accounts for proficiency directly and some of the time variables were collected in bins instead of as a continuous variable. Their primary recommendations to improve the quality of future data collection were to add additional variables as well as record the variables in a continuous form. They also stressed the importance of the Mariners Skills Logbook and how that can improve the quality of data and allow more detailed analysis for training program input. Cunha and Dearth (2019) further recommended logbook improvement that include adding variables and adding electronic tracking format to allow better data collection.

Importantly, Cunha and Dearth conducted the initial pilot study assessment on OOD proficiency, which is a valuable first step for SWOS. By running initial regressions, they were able to provide initial proficiency analysis and identify where data collection methods require improvement to allow more accurate future analysis. Many of the recommendations they proposed in their research were adopted by SWOS for OOD Assessments in 2019 and 2020. Our research will analyze the data collected after adopting some of their proposed changes to both the assessment grade sheet and the survey data collected. The intent is to continue to improve the processes utilized for data collection and analysis to provide support to SWOS for future program reviews and help address the

² Dearth's master's thesis (Dearth, 2019) was written before the technical report.

criticisms as stated in the GAO 2019 report, *Navy Readiness Actions Needed to Evaluate Effectiveness of Changes to Surface Warfare Officer Training*.

5. Summary

For the past two decades, there has been significant research by both the Navy and civilians on the use of simulator training and its effectiveness. The common theme of the literature is that simulator use is effective if designed properly and if there is a clear guidance for its use. The literature shows that the Navy has not implemented simulator-based training efficiently into a culture that prefers on the job training at sea. It also shows that the Navy lacks infrastructure to analyze simulator performance and assessments and requires a focus on improving the quality of data recorded as well improved collection methods. The SWO community has made significant changes to training and job policies intended to improve the Surface Fleet's professional abilities as well as ensure watchstanders are alert. The next step is to focus on improving the system designed to assess a SWO's abilities throughout their career.

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III. SWOS OOD ASSESSMENT AND SURVEY

In this chapter, we will discuss the data and collection methods of the OOD assessments and survey conducted by SWOS in Newport, Rhode Island. The assessments ongoing are a response by SWOS to the collisions of the USS *McCain* and USS *Fitzgerald* and the Comprehensive Review conducted by U.S. Fleet Forces. Recommended modifications were made following the pilot study by Cunha and Dearth (2019) and are utilized in the current assessments. Pilot study and current assessment data and the differences are outlined below.

A. PILOT STUDY DATA

The previous study by Cunha and Dearth in 2019 was conducted using pilot study data. The survey data provided by SWOS was already binned and not a continuous variable (Appendix B).³ The result of their research was an improved assessment grade sheet and an improved survey that expanded the amount of data collected. To improve the quality of data, they changed the survey format from a binned collection method to a continuous numerical method. The proposed changes from their research are what is used in our research for evaluation. The below describes the pilot study data format as compared to the data used in our research conducted in 2019 and 2020.

In the pilot study, the simulator assessment overall performance was evaluated using three metrics: completed with no concerns, completed with concerns and significant problems. They were also evaluated in five subcategories: management of bridge team, bridge resource management, leadership, RoR application and performance under stress. Subcategories were evaluated on a 1-4 grading scale (exceeds standards, meets standards, requires improvement, unsatisfactory).

Survey data in the pilot study also collected time variables of months onboard ship, months deployed and months to qualify SWO were all collected in a bin format. Specifically, the format of collection was a group of month timeframes such as months

³ Pilot study survey (Appendix B) administered in Cunha and Dearth's (2019) research.

deployed being 0-3 months, 4-6 months, 7-11 months or 12-17 months. They also collected information of the Voyage Management System and if they were comfortable and confident in using the systems with a binary yes or no answer.

Evolution experience was collected in the same binned format for CONN and OOD experience. Evolution information collected were number of evolutions conducted for pier work, underway replenishment approach, anchoring, traffic separation scheme, dense traffic operations. Binned metrics on the survey for evolutions experience were none, 1-2, 3-4, 5-6 and 7 and straits transit were evaluated using a similar format with a higher group of binned numbers. They also collected experience underway as CONN and OOD on the watch bill based on less than 20 days, 21-99 days, 100-200 or greater than 200 days.

B. OVERVIEW OF CURRENT ASSESSMENTS

On an ongoing basis, students were randomly selected using an Excel function and the number of assessed students is dependent upon class size and number of available assessors. Students are then assigned to an assessor in the order that the Excel function randomly selected them. There is no specific or planned pairing of a student to an assessor. Prior to formal instruction, on their first day of ADOC, students sign a non-disclosure agreement, complete the survey and the examinations in the morning. They are subsequently assigned a simulator time in the afternoon for a one-hour period.

For the assessment, the student is briefed by the Junior Officer of the Deck (JOOD) on the scenario utilizing a standard script. They then enter the COVE-3 simulator, meet the watch team, and are briefed on bridge, equipment, and equipment settings. The student is then asked if they desire to adjust the default settings on the Voyage Management System and/or the radar. They are then introduced to the Commanding Officer (assessor) and the scenario begins. Each scenario takes approximately 35-45 minutes and is followed by a debrief by the assessor.

OOD assessments were conducted by SWOS staff in Newport, Rhode Island, during a span from April 2019 to January 2020. In total, there were seven assessment periods with a varying number of students in each. For example, in April 2019, there were 14 students evaluated and seven students in August. Our research uses four data sources:

simulator scenario assessments, Rules of the Road (RoR) exam scores, Naval Seamanship and Ship-Handling (NSS) exam scores, and a survey. Simulator assessments are evaluated by an O5 or O6 assessor, while the exams and survey are proctored by staff. In total, 69 students were assessed over the 10 months of our research study.

1. Officer of the Deck Survey

A significant piece of information included in the current research is the self-conducted 2-page survey that consists of 99 total responses (Appendix C). The major changes from the pilot study was the changing of data collection to continuous variables, allowing the Officer to write in the actual number. Recency questions were also added to the survey to allow analysis for both underway and simulator usage in the past 90 days.

The survey first collects general demographic data, including name, date, age, rank, and gender. The survey then asks about general job-specific information such as years of service, commissioning source, college attended, prior enlisted status, and if the student received ship-handling training in school on a simulator. Commissioning source allows four responses: U.S. Naval Academy, Reserve Officer Training Corps, Officer Candidate School and Maritime Academy. These are the four primary methods a SWO will be able to earn a commission in the Navy, but are not all inclusive.⁴ Prior enlisted information consists of two parts, selecting yes or no and the answering what their Military Occupation Specialty or rating was if they selected yes to the previous question.

The next section of the survey is Naval service specific consisting of 13 questions that are handwritten or a given set of answers to select. Which ship they served on with an example that includes the ship name, class and hull number (i.e., USS *Princeton* CG-59). It continues by asking a series of the following timeline questions: when did they check onboard, check-out of their first ship and complete BDOC. Timeline answers are requested to be formatted in month and year. It continues by asking when did they qualify OOD, last conducted a Naval Seamanship and Ship-Handling Training (NSST) and if they are

⁴ Other commissioning sources who were previously allowed to earn their SWO qualification were Limited Duty Officers and Chief Warrant Officers but is no longer authorized (COMNAVSURFORINST 1412.7).

qualified SWO with a date of qualification follow on question. As before, the requested format is month and year handwritten in.

The survey then asks about bridge experience in a series of questions designed in a table format for the student to fill in with the most accurate information they have available from their time onboard. This section starts out with asking if they were in a 3-section (OOD, JOOD, CONN) or 4-section (OOD, OOD under instruction (OOD U/I), JOOD, CONN) bridge team during normal underway steaming. These are the only choices for selection and does not allow a different response, as these are the normal configurations on various ship platforms.

To aid in calculations for the bridge experience tables a note stating, a 4_section watch for six months is approximately 1000 hours. This note provides a baseline when calculating an estimating the number of hours standing watch. It asks the amount of time standing watch as CONN, JOOD, OOD U/I, OOD) in two time periods, total career hours and in the past 3 months, and in two locations, on the ship bridge and in a simulator. There are 14 sections to fill in as OOD U/I is not asked for the simulator portion.

The last section of the survey requests information on the number of special evolutions that they have conducted on both the bridge and in a simulator in the roles of CONN, JOOD and OOD/OOD UI. It is broken into two time periods, total career evolutions and number conducted in the past three months, and in two locations, on the ship bridge and in a simulator. The section consists of 60 total responses based around the number of times they conducted the five following special evolutions: sea and anchor detail (entering/exiting port), underway replenishments, anchoring evolutions, straits or Traffic Separation Scheme transits and high-traffic density watches.

2. OOD Proficiency Check

To assess the OOD simulator proficiency check, the assessor is provided with grading guidelines and a grade sheet.⁵ Evaluator instructions explain setting up a new tab

⁵ The assessment and assessment rubric are not included herein in order to prevent future OODs from seeing the assessment before being assessed

for each student, utilizing the drop-down menu for grades, or assessing yes and no to questions as appropriate. Additionally, the subjective grading consists of a 1 to 5 grading scale for subcategories and a 1 to 7 scale for overall assessment categories. Each evaluator fills out the appropriate tab for each student as he or she grades simulator performance.

The assessment grade sheet consists of general information for tracking of data (date, name and rank of the student, ship, and evaluator name) and has 9 assessment points.⁶ The nine assessment points consist of various grading criteria involving a yes and no response and an assessed grade from scale 1-5. The assessment skills evaluated in the different assessment points are categorized as bridge resource management, internal communications, external communications, RoR knowledge, RoR application and ship-handling execution in the various scenarios. At the conclusion is a summary of the individual assessment skills shown in an objective and a subjective summary table. Objective summary calculates the number of yes responses by the assessor in the assessment scenarios. Subjective summary shows the sum of points accrued in each of the assessment skills. Each the objective and subjective table calculates a percentage correct.

The grade sheet is completed by the assessor evaluating subjective subcategories and an overall evaluation. Subjective categories evaluate the skills: management of bridge team, formality, presence, and leadership, performance under stress and decision making. Subcategories evaluated on a 1-5 scale with the scale evaluated as the following performance: 1-unsatisfactorily, 2-below average, 3-average, 4-above average, 5-exceptional. Overall performance is evaluated on a 1-7 scale: 1-unsatisfactorily, 2-marginal, 3-below average, 4-average, 5-above average, 6-exceptional, 7-excellent. Evaluation is graded throughout the assessment with comment sections being provided for notes and significant concerns able to be annotated.

RoR and NSS Exams

The final metric evaluated by SWOS is student performance on the RoR exam and the NSS exam. The RoR exam questions are utilized from the U.S. Coast Guard test bank

⁶ The assessment and assessment rubric are not included herein in order to prevent future OODs from seeing the assessment before being assessed.

and requires a 90% grade or above to pass by normal fleet standards. However, in this research because the exam is not incorporated into their ADOC grade, there is no passing grade required since it is for research purposes. The exam consists of 40 questions, 20 RoR and 20 NSS questions each and they have one hour to complete the exam.

C. SUGGESTIONS FOR FURTHER IMPROVEMENTS TO DATA COLLECTION

Data quality improvements are always an area of consideration, as lower quality data limits the analysis abilities that are able to be conducted. Through the analysis of the SWOS collected OOD assessment dataset, areas of improvement have been identified. Improving the quality of data collected is a continuous process that began during the pilot study assessment and continues with the following recommendations.

1. Proficiency Assessment Survey

As stated from Dearth's (2019) thesis research, a significant improvement is survey data collection moving from collection in pre-designated bins to continuous variable collection.⁷ This allows for an improved quality of data collection and analysis by researchers. Now, researchers can bin the continuous data as necessary for evaluation, or evaluate the data, in the continuous variable format.

Currently the survey is conducted in a paper format and then scanned by SWOS and sent to NPS researchers. The data is then manually converted from the PDF into excel in order to allow analysis utilizing the STATA software. This method is not only significantly time consuming for both SWOS and NPS but it also increases the possibility of measurement error when transferring the data into excel. Additionally, the completed surveys result in readability issues, given all the data is handwritten, and it does not require students to accurately and completely provide the requested information.

Based on our current research and analysis, we recommend that SWOS implement an electronic survey format for the following reasons:

⁷ Dearth (2019) thesis preceded Cunha and Dearth (2019) technical report.

- Minimize measurement error in future research.
- Electronic storage of data.
- Ensure students complete survey in proper format.
- Minimize potential for not completing survey appropriately.
- Correct readability issues of paper format.

2. Assessment Grade Sheet Improvements

From the Cunha and Dearth (2019) pilot study, the assessment metrics were expanded and an instruction sheet assists assessors in completing the grade sheet. However, the graded metrics are still ambiguous, especially in terms of final overall performance grade. An assessor must decide the difference between earning a 6-excellent versus a 7-exceptional. This is subjective and the instructions provide no guidance on what deems a 6 versus a 7. While it may allow greater flexibility for the assessor, it can also result in a reduction of data quality. This research recommends a grading scale of 1-5 as used by the subcategories, to reduce the ambiguous 1-7 scale currently used to assess overall assessment performance.

The assessment is also prone to varying subjective measures given the different assessors and future turnover of the assessors. SWOS attempts to minimize the subjective impact with a memorandum containing guidelines for conducting the assessments. The differences in grading scales are accounted for by annotating which assessor conducts each assessment. In this research, assessors are used as indicator variables. Finally, a standardization of evaluation methods is recommended to include improving consistency in assessor evaluates, formalization of training on assessment guidelines and to standardization of grading criteria.

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IV. METHODOLOGY AND RESULTS

In this chapter, we discuss the results of the OOD proficiency assessment and data collected by SWOS in Newport, Rhode Island. We discuss the analysis and results of our research in two sections, summary of data and regression analyses results. Of the 69 observations collected between April 2019 to January 2020, three were removed due to data quality issues.⁸ With the low number of observations, finding statistical significance is difficult and for future research, we recommend increasing the study size.

Summary data below shows that the randomly selected sample looks similar to the population. The data used is unpublished and not retrievable by the public and was provided by SWOS. We converted survey and assessment grading into a fully electronic format for analysis. Following summary data, we show our regression analysis which estimates the correlates of OOD performance.

A. SUMMARY OF DATA

Table 1 contains the summary statistics of demographic data collected in the survey. Survey data was collected as continuous variables and binned where useful for analysis. As stated earlier, this is in contrast to Cunha and Dearth's (2019) research, where SWOS collected survey data in bins and required the conversion to an averaged continuous variable by the researchers.

Commissioning source consisted of 20% Officers receiving their commission from Officer Candidate School (OCS), 48% commissioning through the Reserve Officer Training Corps (ROTC), 30% commissioning through the U.S. Naval Academy (USNA) and 2% from the U.S. Merchant Marine Academy (USMMA). The one Officer that attended the USMMA was added to the USNA observation for regression analysis.

⁸ The first observation was removed because the number of hours standing OOD, JOOD and CONN were unrealistic and likely an error. The second observation was removed because the student failed to answer a significant amount of the experience survey questions. Third observation was removed due to answers being inconsistent and not complete.

Ship class include an officer distribution of 15% from Guided-Missile Cruisers (CG), 48% from Guided-Missile Destroyers (DDG), 12% from Landing Helicopter Dock (LHD), 3% from Landing Helicopter Assault (LHA), 8% from Landing Platform Dock (LPD), 2% from Amphibious Command Ship (LCC), and 12% from Landing Ship Dock (LSD). The current allocation of Officers in the study represents a wide distribution of ship classes that first-tour Division Officers serve onboard with the exception of the Mine Counter Measure (MCM) platform, which is not represented. Other classes not represented since second-tour Division Officer are typically assigned to their billets is the Littoral Combat Ship (LCS), Nuclear Aircraft Carrier (CVN) and Patrol Craft (PC).

A new variable bin, ship types, was created in this research to collect ships that are Cruiser and Destroyers (CRUDES) and Amphibious (AMPHIB). The surface Navy community typically refers to officers in these two fields of ship types. Ship type distribution is 64% serving on CRUDES and 36% on an AMPHIB. LCC, although not the typical amphibious type ship, was included in the AMPHIB bin.

Homeport was represented throughout the nine major ports that first tour division Officers normally are stationed. Homeport distribution is 3% in Everett, 18% Mayport, 30% Norfolk, three Pearl Harbor, 28% San Diego, 3% Bahrain, 1% Rota (Spain), 6% Sasebo (Japan) and 8% Yokosuka (Japan). Homeport was also binned into West Coast (22 Officers or 33%), East Coast (32 Officers or 48%) and Overseas (12 Officers or 18%) due to the low number of observations in some of the individual homeports. Gender is presented as 39 male and 27 females, and age is represented and placed in a bin for display summarization in Table 1.

Table 1. SWOS OOD Proficiency Assessment Demographic Summary

	Percentage	Observations
<i>Commissioning source</i>		
Officer Candidate School	20%	13
ROTC	48%	32
US Naval Academy	30%	20
US Merchant Marine Academy	2%	1
<i>Ship class</i>		
Cruiser	15%	10
Destroyer	48%	32
Landing Helicopter Dock (LHD)	12%	8
Landing Helicopter Assault (LHA)	3%	2
Landing Platform Dock (LPD)	8%	5
Amphibious Command Ship (LCC)	2%	1
Landing Ship Dock (LSD)	12%	8
<i>Ship type</i>		
Amphibious ship	36%	24
Cruiser or Destroyer	64%	42
<i>Home port</i>		
Everett, WA	3%	2
Mayport, FL	18%	12
Norfolk, VA	30%	20
Pearl Harbor, HI	5%	3
San Diego, CA	26%	17
Manama, Bahrain	3%	2
Rota, Spain	2%	1
Sasebo, Japan	6%	4
Yokosuka, Japan	8%	5
<i>Home port location</i>		
West Coast U.S.	33%	22
East Coast U.S.	48%	32
Overseas	18%	12
<i>Gender</i>		
Male	59%	39
Female	41%	27
<i>Age (years)</i>		
Less than 25	36%	24
25 through 29	56%	37
Greater than 29	8%	5
Observations		66

Note: OOD proficiency check assessment data of first tour OODs, collected at SWOS from April 2019 to January 2020. Unpublished data used for analysis provided by SWOS. Source: (E. Cotter, personal communication, January 13, 2020).

Table 2 summarized the survey career data. Time variable information pertaining to the Officer's experience includes months onboard first ship, months underway (not deployed), months underway (deployed) and months in shipyard. Qualification and training time variables are also collected in a month and year format and then converted to number of months for each. Total overall experience is recorded by documenting the number of hours the Officer stood in various bridge watch stations both underway and in a simulator.

Table 2 displays presents the mean, standard deviation, median, 5% level and 95% level of the selected variables. The average Officer spent 27 months onboard their first ship, just over 5 months deployed underway and just 5 months underway undeployed. Of note, the average time an Officer spent in the shipyard was 11 months. As expected, an Officer spends more time standing CONN watch, then JOOD and finally OOD based upon qualification progression and pre-requisites. Simulator use is at a much lower level for bridge watch stations and special evolution experience. Based on the average time spent in a shipyard, simulator usage for training and professional development is an area that further research may benefit.

On average, a significant amount of time was spent in a shipyard, when the Officer would not be able to train and maintain proficiency as an OOD or CONN. This is an area where significant investment in simulator training can be leveraged for qualification, training and proficiency.

Table 2. OOD Assessment Total Underway and Simulator Experience.

	Mean	s.d.	Median	5th percentile	95th percentile
<i>Months in position</i>					
aboard ship	27.8	6.2	27	18	34
underway, not deployed	5.3	4.6	5	0	12
deployed	5.0	3.2	6	0	8
in-port, not underway	6.3	4.8	5	0	15
in shipyard	11.5	7.2	10	2	24
Months since attending BRM	10.8	7.0	10.5	1	24
Months taken to qualify OOD	19.5	6.6	19.5	10	30
Months taken to qualify SWO	22.9	6.6	23	14	33
<i>Underway hours in 1st tour</i>					
as CONN	514.7	388.1	450	25	1200
as JOOD	342.0	257.0	300	15	833
as OOD UI	135.5	167.6	100	0	500
as OOD	252.8	255.0	180	5	850
in any position	1245.9	653.6	1212	383	2318
<i>Simulator hours in 1st tour</i>					
as CONN	60.4	163.6	20	0	250
as JOOD	44.6	139.4	5.5	0	200
as OOD	30.0	52.1	10	0	192
in any position	135.0	332.2	40	6	400
<i>Overall hours (underway and simulator)</i>					
as CONN	575.1	450.1	477.5	103	1540
as JOOD	386.5	337.7	300	21	1100
as OOD	283.8	252.8	200	18	855
in any position	1380.9	816.3	1340	414	3319

Note: All variables collected as continuous variables.

Figure 2 displays the distribution of operational tempo recorded in months for OODs in this research. Operational experience is shown as months spent underway (not deployed), months spent underway (deployed), months inport (not underway) and months spent in shipyard.

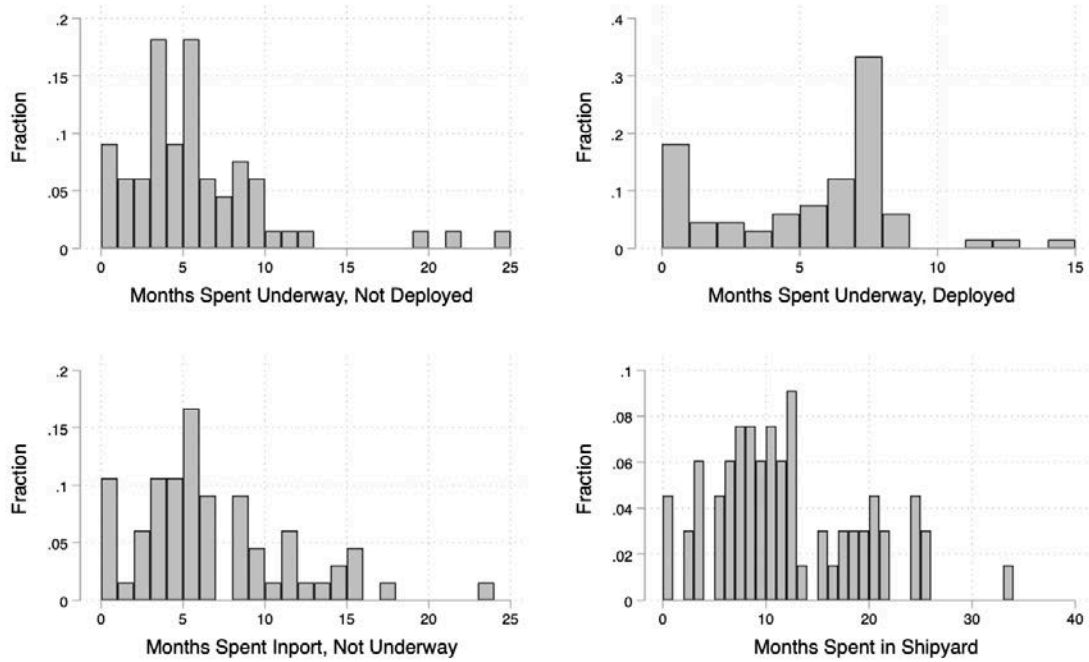


Figure 2. Operational Tempo of First Four OODs.

Figure 3 illustrates the qualification timeframe for an officer attaining their Officer of the Deck letter and their Surface Warfare Officer designation. An Officer of the Deck letter consists of multiple pre-requisite qualifications and the final major pre-requisite qualification before earning the SWO qualification/designation. OOD and SWO qualification timelines vary based on ship schedule, number of ensigns onboard also seeking their qualification, CO training philosophy and other factors. This explains the wide variation from under 12 months to above 20 months for qualification in each category.

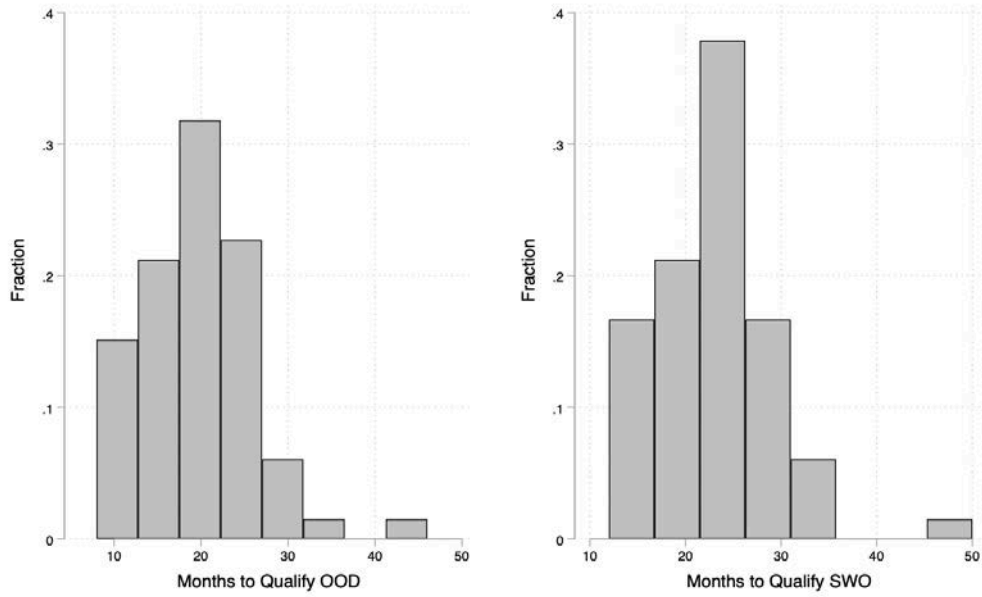


Figure 3. OOD and SWO Qualification Timeframes.

Figure 4 shows the distribution of underway hours experience as CONN, JOOD, OOD and OOD UI. The figure shows a left skewed distribution of experience.

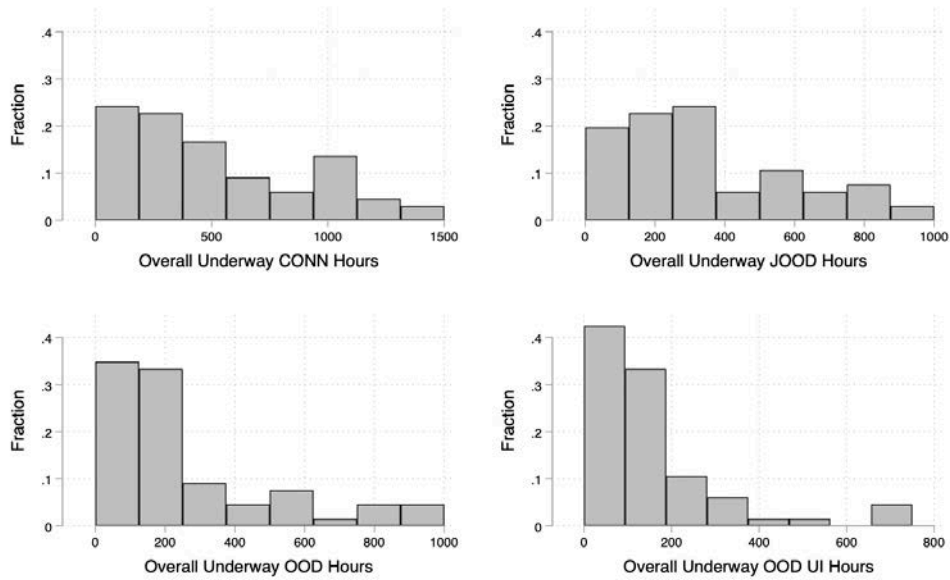


Figure 4. Overall Underway Hours Experience.

Figure 5 illustrates the distribution of OOD experience underway or using a simulator from information provided in Table 2. Overall OOD experience, whether underway or in a simulator is skewed left as well with a significant percentage of OODs with less than 100 hours of experience.

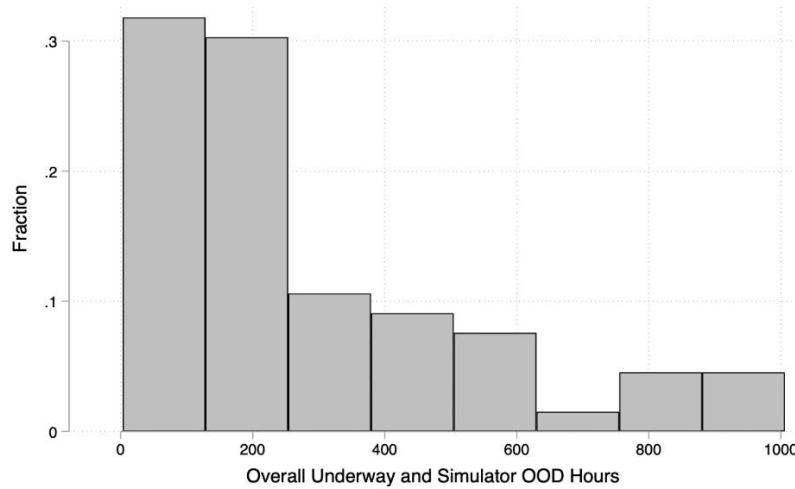


Figure 5. Overall OOD Hours, Underway or Simulator

Table 3 displays special evolution experience of five major evolutions conducted by a Surface Warfare Officer on the bridge: pier work, underway replenishments, anchoring evolutions, Traffic Separation Schemes (TSS) and strait transits, and high traffic density evolutions. The average number of total underway evolutions conducted by and OOD is 25, 31 evolutions as JOOD and 34 as CONN. The middle 50% (median) for some evolutions is low compared to the average (mean) value. The average number of evolutions conducted is increased because of the Officers that had a higher operational tempo and conducting a significant amount of evolutions as shown in the 95th percentile column.

Table 3. Total Overall Underway Special Evolutions.

	Mean	s.d.	Median	5th percentile	95th percentile
<i>Special Evolutions Underway</i>					
<i>Pierwork</i>					
as CONN	7.9	9.7	5	1	15
as JOOD	9.5	31.1	5	0	20
as OOD	7.5	20.0	4	0	18
<i>Underway Replenishment</i>					
as CONN	8.8	8.3	6	2	30
as JOOD	4.6	7.7	3	0	10
as OOD	3.6	7.6	1.5	0	15
<i>Anchorings</i>					
as CONN	1.2	1.7	1	0	5
as JOOD	1.4	3.5	1	0	4
as OOD	1.3	2.4	0	0	4
<i>TSS and Strait Transits</i>					
as CONN	4.4	5.7	2	0	16
as JOOD	5.6	12.8	2	0	18
as OOD	4.2	10.4	1	0	15
<i>High traffic situations</i>					
as CONN	12.3	15.7	5	0	50
as JOOD	9.9	16.1	5	0	30
as OOD	9.0	15.2	3	0	43

Note: All variables collected as continuous variables.

Table 4 shows the same variables as depicted in Table 3 but for simulator usage instead of underway execution of the evolutions. Simulator mean number of evolutions conducted by OOD, JOOD and CONN are overall lower than evolutions conducted underway.

Table 4. Total Overall Simulator Special Evolutions

	Mean	s.d.	Median	5th percentile	95th percentile
<i>Special simulator evolutions</i>					
<i>Pierwork</i>					
as CONN	6.0	6.8	4	0	22
as JOOD	3.2	6.2	1	0	12
as OOD	3.0	4.1	2	0	10
<i>Underway Replenishment</i>					
as CONN	3.9	5.0	2.5	0	15
as JOOD	1.5	3.1	0	0	8
as OOD	2.1	3.6	1	0	10
<i>Anchorings</i>					
as CONN	1.2	2.1	0	0	5
as JOOD	0.5	0.9	0	0	2
as OOD	0.9	1.9	0	0	3
<i>TSS and Strait Transits</i>					
as CONN	4.6	6.7	2	0	24
as JOOD	2.4	3.9	1	0	10
as OOD	2.7	3.8	1	0	10
<i>High traffic situations</i>					
as CONN	3.8	3.8	3	0	10
as JOOD	2.8	4.7	0.5	0	10
as OOD	2.9	3.6	2	0	10

Note: All variables collected as continuous variables.

Table 5 depicts the total evolution experience as a CONN, JOOD and OOD underway or in a simulator and the combined total experience both underway and in a simulator.

Table 5. Total Evolution Experience, Underway and Simulator

	Mean	s.d.	Median	5th percentile	95th percentile
<i>Total underway evolutions</i>					
as CONN	34.6	26.9	25	8	81
as JOOD	31.0	66.2	16	1	71
as OOD	25.6	42.4	12	2	88
<i>Total simulator evolutions</i>					
as CONN	19.5	19.3	14	2	71
as JOOD	10.4	16.0	3.5	0	48
as OOD	11.7	14.7	7	0	39
<i>Total underway or simulator evolutions</i>					
as CONN	54.0	34.2	45.5	13	112
as JOOD	41.4	72.6	20.5	7	95
as OOD	37.3	48.1	22.0	4	97
in any position	132.2	133.6	98	33	282

Note: All variables collected as continuous variables.

Table 6 displays the experience recency of a Surface Warfare Officer based on self-reported information by the Officer. Recency is defined as standing the watchstation or conducting the special evolution within the past 90 days. The Officer completes the survey on first day of ADOC which minimizes the degradation of the recency variables due to time spent in school taking away significance of the variables.

This research is the first collecting recency experience data, therefore there is no baseline of comparison. As shown in Table 6, the average time spent underway as an OOD is 41 hours, while the CONN average is three hours. Simulator use of the same watches is two hours as OOD and underway one hours as CONN. Special evolutions both underway and in a simulator are mostly less than one, on average, being conducted in the past 90 days. Although the mean is above zero on many recency variables, the median is overwhelmingly zero for most variables.

This is an important finding, showing that the top 95% is pulling up the mean from zero when in reality 50% conducted minimal watch or special evolutions as OOD or CONN. This is an area that further research would benefit in determining if and how proficiency is being maintained based on the self-reported data.

Table 6. Underway and Simulator Recency Experience—Within 90 Days

	Mean	s.d.	Median	5th percentile	95th percentile
<i>Underway hours in past 90 days</i>					
as CONN	3.1	16.3	0	0	130
as JOOD	14.6	49.2	0	0	100
as OOD UI	2.7	13.8	0	0	12
as OOD	41.8	96.5	0	0	264
in any position in past 90 days	62.29	109.33	0	0	330
<i>Simulator hours in past 90 days</i>					
as CONN	0.7	3.4	0	0	2
as JOOD	0.2	1.2	0	0	0
as OOD	2.1	6.2	0	0	10
in any position in past 90 days	2.95	8.41	0	0	18
<i>Overall hours (underway and simulator) in past 90 days</i>					
as CONN	3.8	17.0	0	0	10
as JOOD	14.8	49.2	0	0	100
as OOD	43.9	95.9	1	0	264
in any position	65.2	108.8	3.5	0	338

Note: All variables collected as continuous variables.

Figure 6 shows the distribution of experience for underway hours or simulator hours and a combined overall experience in the past 90 days. Recency experience is broken down by the watchstanders CONN, JOOD, OOD and OOD UI. The figure illustrates the extreme left skewed distribution of recency experience by watchstation.

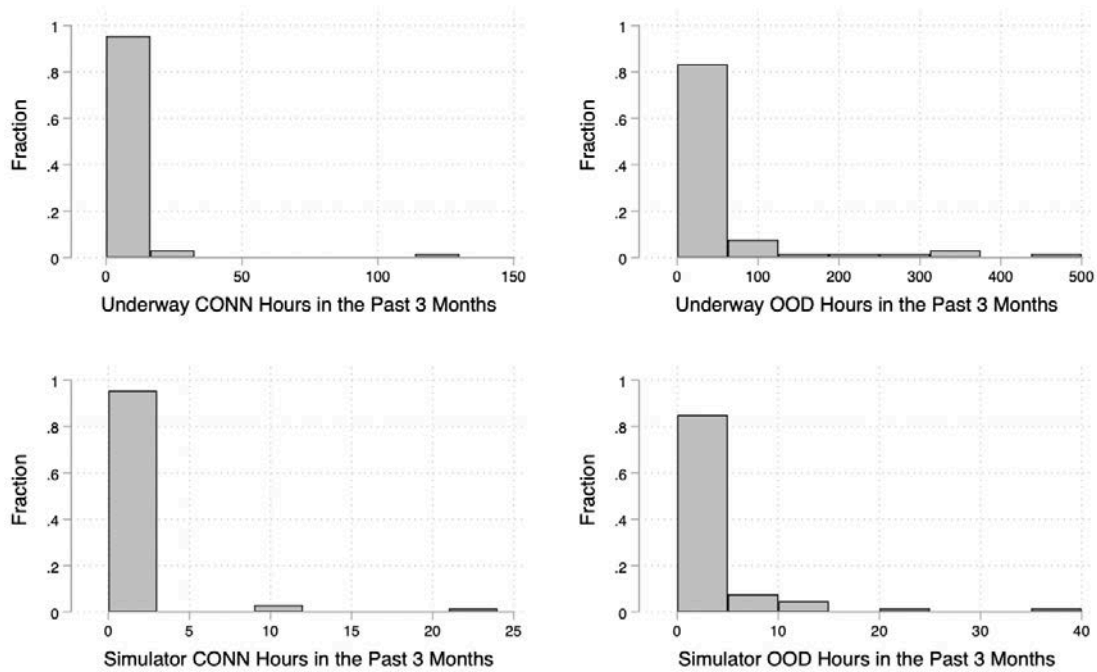


Figure 6. Underway and Simulator Recency Experience—
Within 90 Days

Table 7 depicts the number of special evolutions conducted within the past 90 days. The mean value of each evolution conducted by the three watchstations was below one with the exception of high traffic situations as an OOD, just over one evolution on average in the past 90 days.

Table 7. Underway Special Evolutions Recency—Within 90 Days

	Mean	s.d.	Median	5th percentile	95th percentile
<i>Special underway evolutions in past 90</i>					
<i>Pierwork</i>					
as CONN	0.3	0.7	0	0	2
as JOOD	0.1	0.4	0	0	1
as OOD	0.6	1.3	0	0	4
<i>Underway Replenishment</i>					
as CONN	0.3	0.8	0	0	2
as JOOD	0.1	0.4	0	0	0
as OOD	0.2	0.6	0	0	1
<i>Anchorings</i>					
as CONN	0.0	0.2	0	0	0
as JOOD	0.0	0.2	0	0	0
as OOD	0.3	0.8	0	0	2
<i>TSS and Strait Transits</i>					
as CONN	0.1	0.5	0	0	0
as JOOD	0.0	0.2	0	0	0
as OOD	0.5	2.0	0	0	2
<i>High traffic situations</i>					
as CONN	0.7	4.9	0	0	0
as JOOD	0.1	0.5	0	0	0
as OOD	1.7	7.5	0	0	5

Note: All variables collected as continuous variables.

Table 8 contains the number of evolutions conducted using a simulator instead of underway in the past 90 days. All averages are less than one for each recency variable with the top 95% only have conducted a few evolutions in the past three months in a simulator. Of note, the self-reported data suggests that simulators may not be used frequently in the fleet. Future research into fleet simulator usage may be beneficial as the data currently suggests this an opportunity that can continue to be improved upon.

Table 8. Simulator Special Evolutions Recency—Within 90 Days

	Mean	s.d.	Median	5th percentile	95th percentile
<i>Special simulator evolutions in past 90 days</i>					
<i>Pierwork</i>					
as CONN	0.1	0.6	0	0	0
as JOOD	0.0	0.0	0	0	0
as OOD	0.2	0.7	0	0	2
<i>Underway Replenishment</i>					
as CONN	0.1	0.6	0	0	0
as JOOD	0.0	0.0	0	0	0
as OOD	0.1	0.5	0	0	0
<i>Anchorings</i>					
as CONN	0.0	0.3	0	0	0
as JOOD	0.0	0.0	0	0	0
as OOD	0.1	0.4	0	0	0
<i>TSS and Strait Transits</i>					
as CONN	0.1	0.7	0	0	1
as JOOD	0.0	0.3	0	0	0
as OOD	0.3	0.8	0	0	2
<i>High traffic situations</i>					
as CONN	0.1	0.6	0	0	0
as JOOD	0.0	0.3	0	0	0
as OOD	0.4	1.0	0	0	3

Note: All variables collected as continuous variables.

Table 9 depicts the total recency experience of an Officer underway or in a simulator and total recency underway and in a simulator. Findings show the average number of evolutions conducted in the past 90 days was four. This finding, although informative, does not reflect if the Officer was onboard their ship in the past 90 days. It may be possible they were attending another course in addition to leave and transit time. The data does not provide those details.

Table 9. Total Recency Experience, Underway and Simulator.

	Mean	s.d.	Median	5th percentile	95th percentile
<i>Total underway evolutions in past 90 days</i>					
as CONN	1.3	6.0	0	0	4
as JOOD	0.3	1.3	0	0	2
as OOD	3.2	9.6	0	0	18
<i>Total simulator evolutions in past 90 days</i>					
as CONN	0.5	2.1	0	0	3
as JOOD	0.1	0.5	0	0	0
as OOD	1.0	2.7	0	0	5
<i>Total underway or simulator evolutions</i>					
as CONN	1.8	6.9	0	0	6
as JOOD	0.4	1.4	0	0	2
as OOD	4.2	9.8	1	0	18
in any position	6.4	16.1	1	0	19

Note: All variables collected as continuous variables.

Table 10 contains the assessment performance grades of the four subcategories that are evaluated in addition to overall performance. Of note, 43.9% of Officers received a grade of below average or unsatisfactory on their performance under stress evaluation. This is a concerning finding but the intent of the SWO training changes implemented is that these scores will improve over time. These below average scores may be indicative of a lack of familiarity or not being comfortable performing OOD functions.

Table 10. OOD Proficiency Assessment Subcategory Performance.

Assessment Subcategories	Unsatisfactory	Below Average	Average	Above Average	Excellent
Management of bridge team	7.6%	22.7%	37.9%	25.8%	6.0%
Formality / Presence / Leadership	7.6%	24.2%	39.4%	24.2%	4.5%
Decision Making	10.6%	28.8%	25.8%	30.3%	4.5%
Performance under stress	9.1%	34.8%	24.2%	22.7%	7.6%

Note: Subcategory grading based on a 1-5 scale.

Table 11 shows the other assessment metrics, RoR and NSS exams scores. RoR's mean score was a 90%; however, only 69.7% passed the RoR portion of the exam. Passing score for RoR is defined as receiving a 90% or higher. In comparison, only 42.4% passed the NSS portion of the exam. NSS passing score is defined as an 80% or higher.

Table 11. RoR and NSS Exam Performance

	Mean	s.d.	min	max	% pass
Rules of the Road test	0.90	0.08	0.70	1	69.7%
NSS test	0.75	0.12	0.55	0.95	42.4%

Note: RoR and NSS exam are 20 questions each.

Figure 7 depicts the distribution of RoR and NSS exam scores as shown in Table 11. The figure shows the distribution of both exam grades and depicts the failing score distribution for each. The passing percentage is concerning for both exams considering that all officers in this research have completed their first tour on ship.

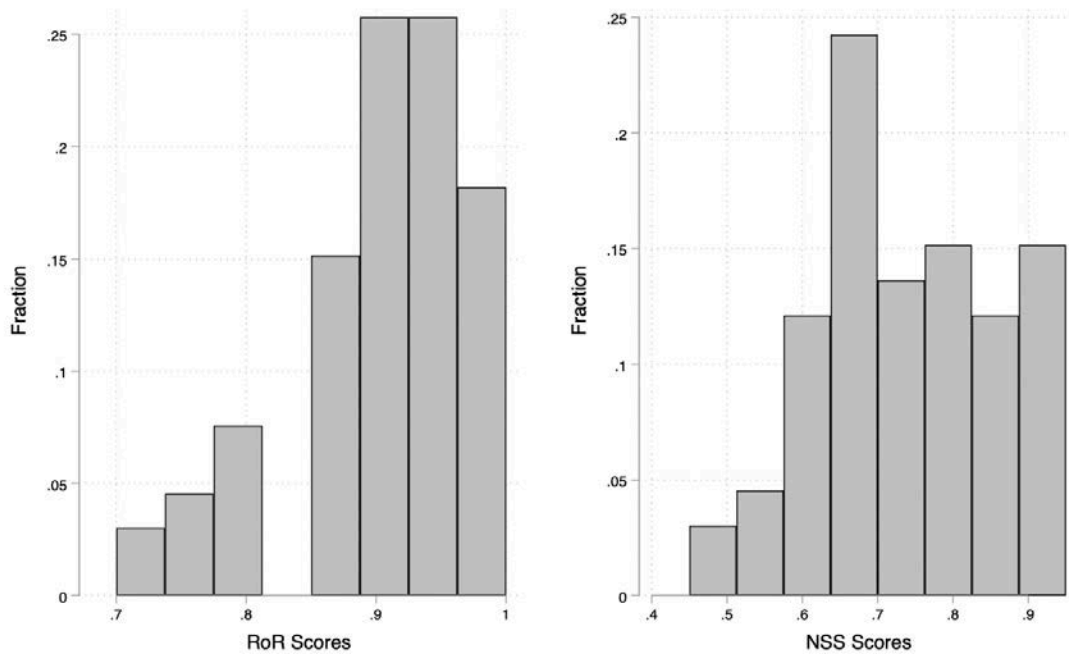


Figure 7. RoR and NSS Exam Grade Distribution

Table 12 compares RoR and NSS exam performance from 2018 to 2019.

Table 12. Comparison of 2018 and 2019 OOD Proficiency Assessment Performance.

2018	Mean	s.d.	min	max	% pass
Rules of the Road test	0.91	0.08	0.60	1	72.0%
NSS test	0.80	0.10	0.50	1	65.2%
2019	Mean	s.d.	min	max	% pass
Rules of the Road test	0.90	0.08	0.70	1	69.7%
NSS test	0.75	0.12	0.55	0.95	42.4%

Note: Passing RoR and NSS scores defined as 90% and 80%, respectively. 2018 scores from previous research by Dr. Cunha and LT Dearth. Source: Cunha and Dearth (2019). The 2019 scores are from SWOS OOD proficiency checks, April 2019-January 2020.

Table 13 shows the overall performance of Officers who participated in this research by conducting the OOD Proficiency Assessment from April 2019-January 2020. Of the 66 Officers, 28 Officers (42%) received a below average, marginal or an overall grade of unsatisfactory. 21 Officers (32%) received an average grade and only 17 (26%) Officers received grade in the above average categories. A concerning finding, 42% of Officers assessed scored below the assessment average grade and four failed the assessment entirely.⁹

⁹ The 42% that scored below the average grade received a grade of below average, marginal or unsatisfactorily.

Table 13. Overall OOD Proficiency Assessment Performance.

	Percentile	Observations
<i>Overall performance</i>		
Exceptional	2%	1
Excellent	12%	8
Above Average	12%	8
Average	32%	21
Below Average	23%	15
Marginal	14%	9
Unsatisfactory	6%	4
Total Observations		66

In Table 14, we show a comparison of OOD proficiency performance from those assessed in 2018 and the current research in 2019.¹⁰ The underlying data is not a direct comparison as the grading collection and grading criteria are different in each year. To allow comparison we binned our 7-point overall grade scale into three comparable bins.

The results are virtually identical with about 66% scoring in the middle categories and smaller percentages either showing significant problems or having an outstanding performance. This is perhaps not surprising since the changes implemented after the 2017 collisions would not have immediately pertained to these Officers. The OODs in this research are at the end of their first tour, while the pilot study data point were varying timeframes.

¹⁰ Current research is referred to as taking place in 2019 and includes an assessment from January 2020.

Table 14. Comparison of 2018 and 2019 OOD Proficiency Assessment Performance.

	% Significant concerns	% Complete with concerns	% Complete no concerns
2018 Overall Performance	18%	66%	16%

	% Unsatisfactory and % Marginal	% Average, Below and Above Average	% Exceptional and % Excellent
2019 Overall Performance	20%	67%	14%

Note: 2018 overall performance provided from previous research by Dr. Cunha and LT Dearth. Source: Cunha and Dearth (2019). The 2019 performance information is from SWOS OOD proficiency checks, April 2019-January 2020.

B. REGRESSION ANALYSIS

In this section we will present the findings of our multi-variate regression analysis to determine factors effecting OOD proficiency. As part of our analysis, due to degrees of freedom considerations, we split the regressions into five separate tables. The tables consist of demographics, experience, special evolutions, recency of experience, and recency of special evolutions. Recency is defined as performing the watchstation or conducting the special evolution in the past 90 days.

For our regression analysis we combined JOOD, OOD UI and OOD into one variable called OOD. This was due to the fact that all three watchstations accomplish a similar objective: exposing an officer to the same type of experiences and decision making. JOOD is commonly an OOD in training, and in many cases will be recommending the decisions and actions to the OOD. JOOD's will also commonly make reports to the ship Commanding Officer (CO), further earning their trust and confidence. We analyze two separate outcome variables, passing the OOD competency assessment and overall grade on the 1-7 scale. The results show that relationships of meaningful magnitude do exist, however, due to the low number of observations, we also observe high standard errors.

This means that although there are correlations to the outcome variables, we cannot confidently state the magnitude of effect of the relationship.

1. Naval Background and Demographic Analysis

Table 15 shows the effect of an officer's naval background and demographic impact on the probability of passing the competency exam and their overall assessment score (1-7 scale). We created binary variables indicating passing each of the four assessment subcategory grades: management of the bridge, leadership, performance under stress, and decision making. The assessor variables are included in each regression as fixed effects.

In analyzing the results of Table 5, Column 1 shows a positive relationship between passing each subcategory and passing the OOD competency assessment. Additionally, column 4 shows correlation between the subcategories and overall assessment grade. We see that performance under stress and decision making are highly correlated to both outcome variables, with decision making having the highest positive impact on the outcomes. This may be because bridge management and leadership are traits are more easily learned, but performance under stress and decision making are more innate abilities. From experience, these abilities are what CO looks for when qualifying and trusting an OOD. This would then mean the assessors would also naturally look for these qualities as well. The assessor variables show a wide variation of grading and their effect on the outcome variables, which points to the subjective nature of the grading, and the need to standardize the grading criteria. Finally, we also see that location variables are not telling us much about the outcome variables.

Table 15. Assessment subcategory grading correlation of the outcome variables

	Pass competency (score \geq 3)			Assessment score (scale of 1-7)		
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Subcategory performance</i>						
Passed management of bridge category	0.117 (0.108)			0.437 (0.320)		
Passed leadership category	0.219** (0.098)			0.391 (0.290)		
Passed performance under stress category	0.227*** (0.080)			1.055*** (0.239)		
Passed decision making category	0.514*** (0.090)			1.146*** (0.269)		
<i>Platform</i>						
Amphibious ship		-0.08 (0.15)	-0.041 (0.143)		-0.31 (0.41)	-0.192 (0.406)
<i>Commissioning source</i>						
U.S. Naval Academy		-0.17 (0.20)	-0.170 (0.199)		-0.13 (0.58)	-0.130 (0.565)
Naval ROTC		-0.11 (0.19)	-0.073 (0.187)		-0.30 (0.54)	-0.205 (0.532)
<i>Home port location</i>						
Forward deployed		-0.12 (0.20)	-0.048 (0.199)		-0.51 (0.57)	-0.330 (0.565)
West coast		0.10 (0.17)	0.121 (0.163)		0.16 (0.47)	0.212 (0.464)
<i>Exam performance</i>						
Rules of the Road exam			0.633 (0.939)			0.858 (2.668)
Navigation, Seamanship & Ship handling exam			1.187* (0.615)			3.585** (1.748)
<i>OOD assessor</i>						
Assessor 1	-0.084 (0.129)	-0.53* (0.30)	-0.451 (0.294)	-0.006 (0.383)	-1.12 (0.85)	-0.907 (0.837)
Assessor 2	-0.056 (0.108)	-0.25 (0.23)	-0.119 (0.234)	-0.050 (0.321)	-0.59 (0.66)	-0.245 (0.665)
Assessor 3	-0.029 (0.093)	-0.24 (0.20)	-0.048 (0.215)	-0.134 (0.276)	-0.76 (0.56)	-0.242 (0.611)
Assessor 4	0.083 (0.196)	0.21 (0.43)	0.133 (0.421)	0.433 (0.581)	0.80 (1.22)	0.619 (1.195)
Assessor 5	-0.101 (0.200)	-0.17 (0.42)	0.138 (0.440)	-0.276 (0.594)	-0.80 (1.20)	0.002 (1.251)
Assessor 6	-0.066 (0.150)	0.05 (0.31)	0.135 (0.301)	-0.935** (0.445)	-0.64 (0.87)	-0.407 (0.855)
Assessor 7	-0.236 (0.147)	-0.29 (0.33)	-0.122 (0.330)	-1.349*** (0.438)	-1.41 (0.93)	-0.921 (0.937)
R-squared	0.794	0.11	0.186	0.777	0.12	0.192

Note: *** p<0.01, ** p<0.05, * p<0.1 N=66. Reference groups: OCS commissioning source; CRUDES ship types; assessor 8. CRUDES ships include destroyers, cruisers. Forward deployed ships are in Rota, Bahrain or Japan. West Coast ships include San Diego, CA, Everett, WA or Pearl Harbor, HI. Mean of pass competency is .576 and assessment score is 3.373.

2. Overall Underway and Simulator Experience Regression Analysis

In Table 16 we analyze underway and simulator experience variables and their effect on both outcome variables. Due to the wide variation of experience amongst the officers, we chose the median values as our analysis point. We created binary variables that reflect whether an officer was above the median value for the experience variables listed in the table. Column 5 shows a correlation to OOD hours above the median and assessment score, as well as column 6 shows a positive correlation to underway OOD hours and assessment score.

Table 16. Underway and simulator experience correlation to outcome variables

	Pass competency (score \geq 3)				Assessment score (scale of 1-7)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Overall Experience</i>								
Above median overall OOD hours, underway or simulator	0.007				0.590			
	(0.141)				(0.392)			
Above median overall OOD hours, underway		-0.050			0.513			
		(0.150)			(0.422)			
Above median overall OOD hours, simulator		-0.076			-0.139			
		(0.135)			(0.377)			
Above median overall watch hours, underway or simulator in any position			-0.017				0.192	
			(0.144)				(0.409)	
Above median overall watch hours, underway in any position				-0.090				0.224
				(0.145)				(0.413)
Above median overall watch hours, simulator in any position				-0.026				0.087
				(0.141)				(0.402)
Covariates included	yes	yes	yes	yes	yes	yes	yes	yes
Assessor FE	yes	yes	yes	yes	yes	yes	yes	yes
R-squared	0.112	0.119	0.119	0.112	0.155	0.147	0.124	0.122

Note: *** p<0.01, ** p<0.05, * p<0.1 N=66. Covariates are amphibious ships, U.S. Naval Academy, NROTC, forward deployed ships and West Coast ships. Mean of pass competency is .576 and assessment score is 3.373.

3. Overall Special Evolution Experience Regression Analysis

Table 17 shows the regression analysis results of overall or total special evolutions experience. We again choose to analyze the variables based on the median data point. The evolution data is collected as each individual evolution category. For analysis, we also created a total sum variable of all evolutions conducted, which is reflected in Table 17. Column 2 reflects that the number of straits transits conducted is significant, and has a

positive correlation to passing the competency assessment. This result make sense because the OOD proficiency assessment is based around a straits transit. Therefore, it can be assumed the more experience an officer has with that type of evolution, then the better they would perform on the proficiency check. Additionally, Column 3 shows a significant relationship between the total number of all evolutions conducted and assessment score.

Table 17. Special evolution experience correlation to outcome variables

	Pass competency (score \geq 3)		Assessment score (scale of 1-7)	
	(1)	(2)	(3)	(4)
<i>Overall Experience - Evolutions</i>				
Above median overall number of evolutions conducted	0.079 (0.142)		0.708* (0.392)	
Above median overall number of pier evolutions conducted		-0.096 (0.164)		0.120 (0.464)
Above median overall number of unrep evolutions conducted		0.070 (0.176)		0.103 (0.500)
Above median overall number of anchor evolutions conducted		0.019 (0.148)		-0.026 (0.419)
Above median overall number of strait transit evolutions conducted		0.357* (0.181)		0.235 (0.512)
Above median overall number of high traffic evolutions conducted		-0.120 (0.167)		0.635 (0.475)
Covariates included	yes	yes	yes	yes
Assessor FE	yes	yes	yes	yes
R-squared	0.117	0.198	0.171	0.208

Note: *** p<0.01, ** p<0.05, * p<0.1 N=66. Covariates are amphibious ships, U.S. Naval Academy, NROTC, forward deployed ships and West Coast ships. Mean of pass competency is .576 and assessment score is 3.373.

4. Recency of Underway or Simulator Experience Regression Analysis

Table 18 presents our findings of recency of underway and simulator experience. Recency in our study is defined as having performed the watch in the past 90 days. We specifically created binary variables to describe recency data, with a one defining any hours and a zero meaning none. This binary indicator was chosen due to the low median recency values as shown in previous tables. Column 5 shows a correlation with overall OOD hours and assessment score, as well as OOD hours underway or in a simulator to assessment score.

Table 18. Recency of underway or simulator experience correlation to outcome variables

	Pass competency (score \geq 3)				Assessment score (scale of 1-7)			
	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
<i>Recency experience - in the past three months</i>								
Any OOD hours, underway or simulator	0.054 (0.154)				0.584 (0.431)			
Any OOD hours, underway	0.087 (0.161)				0.407 (0.449)			
Any OOD hours, simulator	-0.032 (0.173)				0.535 (0.482)			
Any watch hours, underway or simulator in any position	0.095 (0.158)				0.610 (0.442)			
Any watch hours, underway in any position	0.126 (0.165)				0.511 (0.457)			
Any watch hours, simulator in any position	-0.001 (0.169)				0.524 (0.469)			
Covariates included	yes	yes	yes	yes	yes	yes	yes	yes
Assessor FE	yes	yes	yes	yes	yes	yes	yes	yes
R-squared	0.114	0.117	0.122	0.118	0.149	0.159	0.167	0.150

Note: *** p<0.01, ** p<0.05, * p<0.1 N=66. Covariates are amphibious ships, U.S. Naval Academy, NROTC, forward deployed ships and West Coast ships. Mean of pass competency is .576 and assessment score is 3.373.

5. Recency of Special Evolution Regression Analysis

Table 19 shows our analysis of special evolutions recency to the two outcome variables. As we did with the Table 18, we created the binary variable indicting any special evolutions conducted for the same reason as before. We see in Column 3 a correlation of any evolutions being conducted in the past 90 days and assessment score. In Column 4, we see a varying effect of the individual special evolutions to assessment score, as well as their effect to passing the competency in Column 2. This may be due to the low number of observations, and the low recency numbers as illustrated in previous tables.

Table 19. Recency of special evolutions experience, correlation to outcome variables

	Pass competency (score ≥ 3)		Assessment score (scale of 1-7)	
	(1)	(2)	(3)	(4)
<i>Recency experience - evolutions in the past three months</i>				
Any evolutions conducted	0.098 (0.153)		0.604 (0.428)	
Any pier evolutions conducted		0.172 (0.182)		1.267** (0.473)
Any unrep evolutions conducted		-0.094 (0.240)		-1.068* (0.622)
Any anchor evolutions conducted		-0.031 (0.246)		-1.424** (0.637)
Any strait transit evolutions conducted		-0.147 (0.207)		-0.677 (0.536)
Any high traffic evolutions conducted		0.107 (0.231)		1.228** (0.598)
Covariates included	yes	yes	yes	yes
Assessor FE	yes	yes	yes	yes
R-squared	0.119	0.139	0.151	0.288

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$ N=66. Covariates are amphibious ships, U.S. Naval Academy, NROTC, forward deployed ships and West Coast ships. Mean of pass competency is .576 and assessment score is 3.373.

V. ASSESSMENT RECOMMENDATIONS

In this chapter, we will discuss our research recommendations regarding assessment improvements for the SWO community and SWOS. The development of a high-quality assessment system is a process that requires improvements over time. We recommend the following assessment and analysis improvements:

1. Improve the assessment survey.
2. Update assessment grade sheet to minimize subjectivity.
3. Implement an electronic collection format for Surface Warfare Mariner Skills Logbook in addition to the current paper version.
4. Continue OOD assessment research and expand its use to other SWO assessment timeframes.
5. Increasing simulator training, specifically leverage simulators during in-port, maintenance and shipyard periods.

A. IMPROVE ASSESSMENT SURVEY

Currently, the OOD assessment survey format is conducted on paper, which requires students to handwrite in their responses. For NPS research, this requires SWOS to then scan each document and send PDF files for our conversion into an electronic format for software analysis, which greatly increases the possibility of measurement error. For example, in our research we removed three observations due to the low quality of data presented on the paper survey. Also, there are also issues ranging from legibility concerns to incorrect data input. We also noted that we need to think critically of the types of questions we are asking in the survey to ensure we are capturing the intended data. We have two recommendations to improve the survey data collection process of OOD assessments.

1. Implement Electronic Survey Format

To improve the data collection process, we created an electronic format utilizing Microsoft Forms. Microsoft Forms allows for the storing of student responses in a cloud-based system, and a quick overview of received data and exportation to Microsoft Excel for analysis. A Microsoft Forms based survey significantly reduces the possibility of measurement error from student responses, as well as researcher data conversion from paper to an electronic format. Additionally, Forms allows restrictive question parameters to be set by researchers and SWOS. This setting also allows researchers to minimize inconsistent responses that may occur when students do not read questions carefully. Also, it allows the capability of requiring all questions be answered prior to submission. Microsoft Forms also expands the SWOS's capability of administering the survey to a potentially larger population, allowing more flexibility in future assessment periods. To utilize the survey, SWOS could email out the link to the intended recipients and track live responses, while electronically storing the data. For future research and analysis, we believe this is the next step in improving our assessment process, as well as improving our data storage.

2. Improve Survey Questions

During our research and in discussion with SWOS, we determined that the assessment survey may be collecting too much data, and we need to think critically about the questions presented. The change from the pilot study assessment survey (Appendix B) to the current assessment survey (Appendix C) was based upon Cunha and Dearth's (2019) research, and solved many issues discussed previously about the data format. Now that we are able to look at the new assessment methods, a more streamlined survey may result in better quality data.

We recommend removing the questions about JOOD experience as we really care about CONN driving and OOD experience. Additionally, under special evolutions questions we should remove the high traffic density scenario, as it appears subjective, and this information is already specifically recorded as part of the Mariners Skill Logbook entry

(Appendix D). These changes result in a more streamlined survey that does not change the major key variables recorded, allowing year-to-year comparisons in future research.

B. REMOVE SUBJECTIVITY FROM ASSESSMENT GRADE SHEET

Previous improvements to the assessment (Cunha & Dearth, 2019) have been focused on removing subjectivity from the process and ensuring formality is followed. In January 2020, the Director of Fleet Training at SWOS, signed a memorandum to OOD participants (Appendix E). This memorandum formalizes the assessment process background, states the purpose and explains an overview of the process (Mahon, personal communication, 2020). Based on SWOS's intent and in further decreasing subjectivity, we recommend the following changes.

The current assessment overall grading scale is a 1-7 scale where 1-unsatisfactorily, 2-marginal, 3-below average, 4-average, 5-above average, 6-exceptional and 7-excellent. This scale provides significant variation but also instills a high amount of subjectivity. The difference between two grading points is vague and the grading sheet instructions provides minimal guidance to the graders. We recommend a 1-5 grading scale identical to the subcategory 1-5 scale. The overall assessment performance would then be 1-unsatisfactory, 2-below average, 3- average, 4-above average, 5- excellent.

The new scale will still allow significant variation for analysis but removes the subjectivity of the 1-7 scale. Additionally, we recommend adding general criteria of what each grade would mean while underway for performance guidelines. A grade of 1-unsatisfactory is a failure and would not result in qualification in the fleet. Grade 2-below average would result in a probationary type of qualification where a Captain may have the OOD stand daytime watches with an experienced JOOD and CONN to help when needed. Grade-3 is a trusted OOD that the Captain feels comfortable with them standing watch at night. Grades 4-above average and 5-excellent, are high performing OOD's who would be the officers a Captain would want training the more junior officers and future OOD's.

C. IMPLEMENT ELECTRONIC MARINER SKILLS LOGBOOK

The Surface Warfare Mariner Skills Logbook brings a much-needed tracking of SWO experience, while also allowing future analysis based on these records. As the use of logbooks and the processes take hold in the Navy, we recommend research into an electronic logbook format that would be used in conjunction with the paper logbook. This is similar to how other entities within the military and in the civilian sector log their experience and track proficiency. Additionally, we recommend future research utilizing the end of tour summary letter data of the Mariner Skill logbook be utilized. Without research access to each individual's logbook, and the current lack of an electronic logbook format, only the end of tour summary letter provides researchers with the valuable information the logbooks contain.

D. CONTINUE OOD ASSESSMENT PERFORMANCE RESEARCH

We recommend continuing research, with a partnership with SWOS, to assist in answering the questions of what determines a high quality OOD and what the performance trend is year-to-year. Continuing the funding and research is critical for trend analysis and to determine effectiveness of the policy implementations by SWO community. The short- and long-term impacts of policy and program changes are only known if a quality assessment and feedback loop is implemented by an organization. This is what NPS and SWOS have intended to determine with the pilot study data and this current research.

However, while the question may arise as to why the data from the pilot study wasn't combined with these efforts to improve statistical significance. The pilot study data, was important and was the initial attempt at answering performance questions. It ultimately looked at different population groups as well as lacked continuous data variable collection. With the changes that were made, our research was able to more accurately track OOD summary data and experience. While, the next phase of research will be able to utilize our data, due to minimal proposed future grading changes, and expand the number of observations to allow quality analysis results to be acquired.

To allow analysis at the various phases of a SWO's career, we also recommend using this assessment grading criteria and survey in the other SWOS trainings and any

future fleet performance spot checks. By using similar grading criteria in all assessment, it allows researchers to properly assess each career milestone and creates the uniformity of expectations throughout the SWO community. Overall our proposal is to continue research, expand the number of observations to allow proper regression analysis and utilize the same assessment type in other SWO training schools overseen by SWOS.

E. INCREASE SIMULATOR TRAINING

Policy changes have increased the amount of formalized training a SWO receives throughout their career, but more specifically the amount of training received in their initial officer training tour. The data shows that the average time spent in the shipyard was about 11 months out of a 24 month first-tour.¹¹ While almost an average of 50% of a tour was spent in the shipyard, the median 50% of officers conducted 10 hours of simulator training as an OOD and 40 hours in any position (OOD, JOOD or CONN).

Our literature review research supports simulator training as being an effective and low risk training environment if implemented appropriately. As a result, we recommend researching the amount of time spent in simulators, specifically while in a maintenance availability or shipyard, and increase simulator requirements during these timeframes. Although maintenance is a priority during these timeframes, a high emphasis in the SWO community must be placed on professional development, training and maintaining proficiency during these periods. A SWO's core principal is safe operation of the ship, and the ability to conduct ourselves as professional mariners at all times.

F. CONCLUSION

The Surface Warfare Community and the Navy must continue to fund, support and improve assessment practices. A well-designed assessment is a feedback mechanism that allows analysis of implemented policies and training programs, while also providing insight into future policy shaping. The pilot study directly led into our research with the implemented grading, survey and data collection changes they proposed. We see a

¹¹ First-tour length has increased from 24 months to 30 months. Future research will reflect the longer first tour length and experience variables may or should increase due to this change.

significant improvement in the quality of data collected when compared to the pilot study but our proposed recommendations can further help to remove subjectivity that currently exists in the grading criteria.

By working in a partnership with SWOS, our goal is to continue to improve the SWOS OOD assessment process. Our research recommendations are summarized as 1) move the data collection process forward to an electronic format 2) improve the grading criteria and remove subjectivity 3) continue the assessment research and expand to other assessment periods and 4) research simulator usage during in-port, maintenance and shipyard periods.

Although we are not able to statistically determine the OOD proficiency determinants due to the low number of observations, continued research should be able to answer that question. In the future, the electronic collection methods will improve the data quality and allow timely analysis, while reducing measurement error. Additionally, logbook data can be utilized for increased accuracy and analysis. Ultimately, continued research will allow improved statistical and trend analysis of Surface Warfare Officer mariner skills proficiency, and support the Navy in training and maintaining our professional abilities to accomplish our mission.

APPENDIX A. LOGBOOK END OF TOUR SUMMARY LETTER

Source: (COMNAVSURFOR, 2019)

COMNAVSURFORINST 1412.7
16 Dec 2019

SAMPLE COMMANDING OFFICER END OF OFFICER'S TOUR LETTER TO
PERS-41

1412
Ser CG XX/XXX
DD Mmm YY

From: Commanding Officer, USS SHIP (CG XX)
To: Commander, Navy Personnel Command (PERS-41)

Subj: MARINER SKILLS LOGBOOK DATA SUMMARY OF ENS SALT E. SAILOR, USN,
11XX

1. During ENS Salt E. Sailor's tour on USS SHIP (CG XX) from Month YYYY – Month
YYYY.

2. Watch Experience

a. Underway Bridge Watch Hours

(1) OOD

(a) Qualified

(b) Under Instruction

(2) Bridge watch other than OOD or OOD (U/I)

b. Bridge Watch Simulator Hours

(1) OOD (qualified) or (under instruction)

(2) Bridge watch other than OOD or OOD (U/I)

(3) Dates attended BRM

3. Special Evolutions Experience (Day/Night)

a. Sea and Anchor Details:

b. Underway Replenishments:

c. Anchoring Evolutions:

COMNAVSURFORINST 1412.7
16 Dec 2019

Subj: MARINER SKILLS LOGBOOK DATA SUMMARY OF ENS SALT E. SAILOR, USN,
11XX

- d. Straits/Congested Waterway Transits:
 - e. Other (specify particular evolution or event):
4. CO's Overall Assessment: (comments if desired).

/s/
C. O. SHIP

Copy to:
ENS Sailor

APPENDIX B. PILOT STUDY ASSESSMENT SURVEY

Pilot study research survey referenced in Cunha and Dearth's technical report. Source: (Cunha & Dearth, 2019).

Name: _____ **Ship:** _____

Commissioning Source:

Naval Academy

ROTC: School: _____

OCS:

Fill in the circle that closely applies:

How many months have you been assigned to your current ship?

0-6 7-12 13-18 >18

Number of months you were on deployment?

0-3 4-6 7-11 12-17 >18

Number of months it took you to qualify as an OOD?

0-6 7-12 13-18 >18

If SWO Qualified, the number of months it took you to qualify?

Not Qualified 1-6 7-12 13-18 >18

I feel comfortable operating the RADAR/ARPA to its fullest extent in congested waterways?

Yes No

When using the VMS system on your ship, do you understand from where the system gets its inputs from and how the system determines your position?

Yes No

Do you feel confident when making Bridge to Bridge radio calls?

Yes No

When was the last formal BRM training you received from the Navigation, Seamanship, and Shiphandling Training (NSST) center?

Never 1-3 months 4-11 months 12-18 month > 19 months

Watch station specific questions

Conning Officer: The number of evolutions that you have conducted.

Getting underway / Mooring to a pier:

None 1-2 3-4 5-6 > 6

Underway replenishment (approach):

None 1-2 3-4 5-6 > 6

Anchoring:

None 1-2 3-4 5-6 > 6

Transit a designated Traffic Separation Scheme (TSS):

None 1-2 3-4 5-6 > 6

Number of straits transits conducted:
None 1-4 5-8 9-12 > 12

Approximate number of days underway where you were assigned Conning Officer on the watch bill:
< 20 21-99 100-200 >200

As the Officer of the Deck (OOD): The number of evolutions that you have conducted.

Getting underway / Mooring to a pier:
None 1-2 3-4 5-6 > 6

Underway replenishment (approach):
None 1-2 3-4 5-6 > 6

Anchoring:
None 1-2 3-4 5-6 > 6

Transit a designated Traffic Separation Scheme (TSS):
None 1-2 3-4 5-6 > 6

Number of straits transits conducted:
None 1-4 5-8 9-12 > 12

Approximate number of days underway where you were assigned OOD on the watch bill:
< 20 21-99 100-200 >200

APPENDIX C. CURRENT OOD ASSESSMENT SURVEY

Survey for this research created and provided through personal communication. Source: (Cunha & Dearth, personal communication, 2019).

Officer of the Deck Survey

Name: _____ **Date:** _____
Home port: _____ **Age:** ____ **Years of Service:** _____
Prior enlisted? Yes / No **If yes, rating/MOS:** _____ **Sex:** Male / Female
Commissioning Source: Naval Academy / ROTC / OCS / Maritime Academies

If not the Academy, which school? _____
 Did you receive ship-handling training in school on a simulator? Yes/No

Which ship did you serve on (e.g., USS Princeton CG-59)? _____

When did you check onboard? (Month/year) _____
 When did you check-out of your first ship? (Month/year) _____
 When did you complete BDOC? (Month/year) _____

Since you checked onboard, how long did you spend...
 In a shipyard or pier-side maintenance availability? _____ months
 In-port and not underway? _____ months
 Underway, not on deployment (including any cross-deck periods)? _____ months
 Underway, on deployment? (including any cross-deck periods)? _____ months
**The total sum should equal the length of your first tour.* _____ months

When did you qualify OOD? (Month/year) _____
 When was your last formal BRM training with the Navigation, Seamanship, and Shiphandling Training (NSST) center? (Month/year) _____
 Are you SWO qualified? Yes / No **If so, when did you qualify?** (Month/year) _____

Bridge Experience

During normal underway steaming, were you in a three-person bridge team (OOD, JOOD, & CONN) or a four-person bridge team (OOD, OOD (U/I), JOOD, & CONN)? 3-person / 4-person

Please provide the number of hours you have spent on the bridge and in simulators in various roles. (A 4 section watch for 6 months is approximately 1000 hours)

	On the bridge		In a simulator	
	Total career hours	Hours in last 3 months	Total career hours	Hours in last 3 months
As Conning Officer (CONN)				
As Junior Officer of the Deck (JOOD)				
As Officer of the Deck (OOD)				
As OOD Under Instruction (U/I)				

Special evolutions. Please provide the number of evolutions that you have conducted on the bridge and in simulators in various roles.

As a Conning Officer (CONN):

	On the bridge		In a simulator	
	Total career evolutions	Evolutions in last 3 months	Total career evolutions	Evolutions in last 3 months
Sea & anchor details (Entering/exiting port)				
UNREPs				
Anchorings				
Straits or Traffic Separation Scheme transits				
High-traffic density watches				

As a Junior Officer of the Deck (JOOD):

	On the bridge		In a simulator	
	Total career evolutions	Evolutions in last 3 months	Total career evolutions	Evolutions in last 3 months
Sea & anchor details (Entering/exiting port)				
UNREPs				
Anchorings				
Straits or Traffic Separation Scheme transits				
High-traffic density watches				

As an Officer of the Deck (OOD) or OOD (U/I):

	On the bridge		In a simulator	
	Total career evolutions	Evolutions in last 3 months	Total career evolutions	Evolutions in last 3 months
Sea & anchor details (Entering/exiting port)				
UNREPs				
Anchorings				
Straits or Traffic Separation Scheme transits				
High-traffic density watches				

APPENDIX D. MARINER SKILL LOGBOOK EXAMPLE

Example provided by a published instruction. Source: (COMNAVFURFOR, 2019, p. 2-1).

Special Evolution Tracker												
Date		Location: Coastal San Diego										
17Feb18		Position			Evolutions					Traffic/Watch Complexity		
D	N	OOD	CONN/JOOD	OTHER	S&A	ANC	RAS	ST	Other	Low	Med	High
X		X				X				X		
Notes: - Daytime anchorage at Coronado Roads anchorage 118 - Variable winds - .5 kts current, swells from the west - 75 yards from intended anchorage location												

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APPENDIX E. OOD COMPETENCY CHECK MEMORANDUM

Memorandum provided by personal communication with SWOS. Source: (E. Cotter, personal communication, January 14, 2020).

13 Jan 20

MEMORANDUM

From: Director, Fleet Training (N72), Surface Warfare Officers School Command

To: Fleet OOD Competency Check Participants

Subj: 2020 FLEET OOD COMPETENCY CHECK PROCEDURE

Ref: (a) COMNAVSURFORINST 1412.7, SWO Career Manual

1. Purpose. The Fleet Training Director (N72) Surface Warfare Officers School (SWOS) will conduct Officer of the Deck (OOD) Competency Checks from January through April in Fleet Concentration Areas. The candidates shall be randomly selected, 75% OOD qualified First Tour Division Officers on CRUDES, AMPHIB, and MCM ships. The remaining 25% will be Junior Officer of the Deck (JOOD) course graduates (started June 2019), with greater than 4 months on a ship since graduation, regardless of completion status of OOD qualification.

2. Method. SWOS will send an assessment team to the Fleet Concentration Areas - Sasebo, Yokosuka, Mayport, San Diego, Norfolk, Everett, and Pearl Harbor. The checks will take place at local Navigation, Seamanship, and Shiphandling Trainers (NSST) or JOOD course facilities and assess both First Tour Fleet OOD and JOOD course graduate ("candidate") abilities to, IAW the SWO Manual, Chapter 4, "effectively and safely handle and navigate a ship and lead a watchteam in a variety of light, medium, and high intensity virtual scenarios."

3. Candidate Requirements. Candidates are only required to bring their Mariner Skills Logbook as a reference for data collection in the experience survey. To maintain the integrity of the OOD Competency Check, candidates will review and sign a non-disclosure agreement and cannot discuss any portion of the assessment with other personnel. Uniform for all participants is NWU Type III.

4. NSST/JOOD Facility Requirements. NSST/JOOD facilities will verify possession of the simulator scenario for required platforms and conduct preliminary runs to validate operation. NSST/JOOD system operators will provide overall control of the scenario and follow guidance from the assessor.

5. Procedure. The OOD Competency Check has two parts, a NSS written test and a simulator scenario evaluation. Upon check-in, the candidates will complete experience surveys. For the simulator scenario, the candidate will fill the OOD role and SWOS personnel will fill the JOOD and CONN roles. The SWOS assessor will fill the Commanding Officer role. Prior to commencing the scenario, SWOS personnel will conduct a simulator familiarization and a scene-setter brief. After the scenario, the SWOS assessor will debrief the candidate. Results (No Concerns, Minor Concerns, Significant Concerns) will be forwarded to the candidate's

Commanding Officer in a summary letter, including specific results from the written test and comments from the SWOS assessor.

6. Schedule. TYCOM Force Navigators, via ISICs, will schedule candidates at each location. A notional daily schedule is provided below:

Notional Daily Schedule	
Time	Event
0730 – 0800	Morning group Check-in
0800 – 0900	Candidate written tests / 1 st candidate in scenario
0900 – 1000	2 nd candidate in scenario / 1 st candidate written test
1000 – 1100	3 rd candidate in scenario
1100 – 1200	4 th candidate in scenario
1200 – 1230	Lunch
1230 – 1300	Afternoon group Check-in
1300 – 1400	Candidate written tests / 1 st candidate in scenario
1400 – 1500	2 nd candidate in scenario / 1 st candidate written test
1500 – 1600	3 rd candidate in scenario


C. M. MAHON

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