Assessment of STCW Competencies Aboard a Maritime Academy Training Vessel

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Abstract. Each summer, approximately 340 deck cadets sail aboard the United States Training Ship Golden Bear as part of their sea time requirements for Officer in Charge of a Navigation Watch (OICNW). These cadets are students enrolled in the California State University Maritime Academy (Cal Maritime) or the Texas Maritime Academy in the United States. During this training period, the cadets receive training on watchstanding, terrestrial and celestial navigation, and hands-on skills such as mooring, marlinspike seamanship, firefighting and first aid. In addition, training is conducted using the Full Mission Bridge (FMB) simulator and the part-task simulator fitted on board the Golden Bear.

While on board, cadets are assessed on 143 STCW competencies from the OICNW, Able Seafarer Deck, and Ratings Forming a Part of the Navigation Watch tables. The remaining STCW competencies are assessed ashore, in the classroom, laboratories, simulators, or aboard the maritime academy’s small vessels. Although the cadets also get OICNW sea time on board commercial vessels, Cal Academy does not accept STCW assessments conducted during this commercial training period. Nor does the Academy accept the transfer of STCW assessments from other universities or schools.

In this paper, the authors examine the advantages and disadvantages of sea time aboard academy training vessels as compared to sea time on board commercial vessels. In addition, details are provided of the on board training program for deck cadets on the Golden Bear including the use of our shipboard Navigation Laboratory (Nav Lab) which is equipped with state-of-the-art simulation equipment. This is intended to inform the international Maritime Education and Training (MET) community and those who may wish to utilize aspects of this training program aboard their own training vessels.

Keywords: Maritime Education and Training, STCW, assessment, simulation training, training ship

1. Introduction

In order to achieve certification as an Officer in Charge of a Navigation Watch (OICNW), cadets must document twelve months of sea time aboard a qualifying vessel and be assessed in a wide range of professional knowledge areas and skills sets as determined by the International Maritime Organization (IMO). These requirements are specified in the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW) [1]. In addition to the STCW requirements, maritime cadets at the California State University Maritime Academy (Cal Maritime) must also meet the national licensing standards of the United States Coast Guard (USCG). These national standards licensing requirements further enhance the STCW code by requiring more detailed and thorough knowledge, understanding and proficiency in certain areas [2].

Degree granting maritime universities approach STCW assessments through various methodologies to ensure the degree/license candidate receives all required assessments during their tenure. In order to graduate with a Bachelor of Science degree in Marine Transportation and to be certified by the United States Coast Guard as Officers in Charge of a Navigation Watch, cadets at Cal Maritime receive the majority of their STCW assessments while onshore during the their regular academic year; however, as enrollments have increased along with the number of STCW and national requirements, the training program aboard the academy’s vessel, U.S. Training Ship Golden Bear (Figure 1), has increasingly been integrating more assessments into the onboard curriculum. With 320 deck cadets on campus on an
average year, the resulting 173,760 annual assessments require a significant investment in time and manpower.

![U.S.T.S. Golden Bear](image)

**Figure 1 U.S.T.S. Golden Bear**

Cal Maritime deck cadets participate in two training cruises aboard the *Golden Bear*. After their first year at the academy, students sail for approximately 65 days as Third Class Cadets. During this training period, they are assessed on many of the competencies from the Ratings Forming Part of the Navigation Watch (RFPNW) [3] and Able Seafarer Deck (ASD) [4] tables. At the start of their fourth year at the academy, students return to the *Golden Bear* for 65 days as First Class Cadets, when they are assessed on several OICNW tasks [5]. The ship is at sea for two 65-day training periods, with approximately half of the students participating in each training cruise.

While on board the *Golden Bear*, cadets are assessed on 143 STCW tasks. While 143 competencies may seem like a manageable number of assessments to cover during a 65 day training cruise, with 340 deck cadets on board the training ship during the two training cruises of 2016, the resulting 48,620 individual assessments require a significant investment of time, manpower, finances, and educational technology.

The integration of STCW assessments into the training program on the *Golden Bear* has been challenging and has, in some cases, resulted in a significant reduction of training. For example, in previous years the shipboard simulation center on vessel was used with great success to train third class cadets in radar plotting, ARPA, ECDIS, and navigation piloting techniques [6]. In recent years, however, the simulator has primarily being used to conduct STCW assessments and the radar training has been reduced from four days to two days while the ARPA, ECDIS and piloting training have been eliminated.

2. Training Ships vs. Commercial Vessels

As mentioned, in order to become licensed as an Officer in Charge of a Navigation Watch, a cadet must log twelve months of sea time [1]. There is a frequent debate in Maritime Education and Training (MET) circles about whether cadet sea time is best served on academy training ships or on board commercial ships [7]. Cadets at many, probably most, of the world’s maritime universities serve the bulk of their days at sea aboard commercial vessels. Others, such as the cadets at the state maritime academies in the United States, obtain most of their sea days aboard training ships, also known as “schoolships”. Although there are strong proponents of both systems, the reality is that both methods have advantages and disadvantages.

2.1 Advantages and disadvantages of schoolship training
There are several advantages of schoolship training. 1. The university can control the training environment, including the vessel’s itinerary and the daily routine, in order to achieve the educational goals. 2. The vessel is manned by a crew of professional maritime educators that have extensive experience in training and assessing cadets in their knowledge and skills. 3. The ships typically have abundant education resources such as classrooms, library, computer labs, and simulation facilities, and 4. The maritime university has direct control over the assessment of the required STCW knowledge, understanding and proficiency (KUP).

There are, however, disadvantages to schoolship training as well. 1. There are a lot of cadets on the training ships, as many as 700 in some cases [7]. As a result, there are limited opportunities to stand watch on the bridge. At Cal Maritime, we typically sail with 60 to 70 4th year deck cadets (seniors). During a 65 day training cruise, each cadet will stand only 4 or 5 watches as the Cadet Watch Officer on the bridge. 2. The cadets get a limited understanding of the realities of working on commercial vessels, and 3. Training ships are very expensive to operate and maintain.

2.2 Advantages and disadvantages of commercial ship training

Cadet sea service on commercial ships also has its advantages. 1. Cadets gain a realistic understanding of life and work aboard a commercial ship, and 2. The shipping company pays most of the costs of the training, greatly reducing the expense to the academy and to the cadet.

There are some disadvantages, as well, to cadet sea time obtained on commercial vessels. 1. On some ships, cadets spend more time painting and doing maintenance than they do on watchkeeping. 2. The training opportunities available to the cadets will vary greatly from vessel to vessel, depending on the type of ship and the operational schedule. 3. Vessel officers often do not have time or teaching experience necessary to effectively train cadets in essential skills. 4. Placing cadets on commercial vessels can be challenging with the availability of cadet berths being determined by economic factors and pressure from other maritime institutions, and 5. The assessment of STCW KUPs conducted on the vessel is out of the control of the academy. As a result, some KUPs might not be assessed at all due to the vessel’s operational schedule or type. In such cases, the academy must make an individual assessment plan for each cadet, to ensure that all KUPs are assessed prior to graduation.

2.3 The hybrid approach

There is a third option in the debate between commercial sea time and training ships. That option is a hybrid approach in which cadets obtain sea time in two or more ways. This approach seeks to maximize the advantages of both of the options, above, while minimizing the disadvantages. For example, Cal Maritime cadets sail for two summers (approximately 130 days) aboard the Training Ship Golden Bear and one summer (approximately 100 days) on commercial ships. The remaining sea time is obtained through simulation training and operation of the academy’s smaller vessels during the academic year. All assessments of STCW KUPs are conducted at the academy, during the academic year, or on board the training ship during the summer training cruises. At Cal Maritime we have chosen to administer all of the assessments ourselves so that we don’t have to create an individual assessment plan for each cadet that would otherwise be necessitated by their varying experiences while on their commercial vessel.

3. Assessment of STCW KUPs at Cal Maritime

Conducting assessments of competence in STCW KUPs is a modern reality for Maritime Education and Training establishments. In order to graduate with a Bachelor of Science degree in Marine Transportation and to be certified by the United States Coast Guard (USCG) as Officers in Charge of a Navigation Watch, cadets at Cal Maritime must complete all of the requirements in several of the STCW tables. These tables are as follows: Officer In Charge of a Navigation Watch (Table A-II/1), Rating Forming Part of a Navigation Watch (Table A-II/4), Able Seafarer Deck (Table A-II/5), GMDSS Radio
Operator (Table A-IV/2), Basic Training – Personal Survival Techniques (Table A-VI/1-1), Basic Training – Fire Fighting (Table A-VI/1-2), Basic Training – Elementary First Aid (Table A-VI/1-3), Basic Training – Personal Safety and Social Responsibilities (Table A-VI/1-4), Proficiency in Survival Craft (Table A-VI/2-1), Fast Rescue Boat (Table A-VI/2-2), Advanced Fire Fighting (Table A-VI/3), Medical First Aid (Table A-VI/4-1), Medical Care (Table A-VI/4-2), Ship Security Officer (Table A-VI/5), Security Awareness (Table A-VI/6-1), and Seafarers with Designated Security Duties (Table A-VI/6-2).

The United States Coast Guard has issued further guidance to US mariners and maritime educators concerning STCW assessments through a series of Navigation and Vessel Inspection Circulars (NVICs). The NVICs elaborate and expand upon the STCW code and provide multiple assessment tasks for each competence and associated KUPs. For example, the first competence in STCW Table A-II/1, OICNW, is “Plan and conduct a passage and determine position” and the first KUP is “Ability to use celestial bodies to determine the ship’s position” [5]. The national assessment guidelines for that KUP, as published in NVIC 12-14 [2], require the assessment of six independent tasks: 1.1.A - Adjust a sextant, 1.1.B - Measure the altitude of the sun, 1.1.C - Measure the altitude of at least 3 stars, 1.1.D - Measure the altitude of the sun at meridian passage (LAN), 1.1.E – Celestial running fix, and 1.1.F - Plot star fix. In all, a Cal Maritime cadet needs to be assessed on 543 tasks. With 320 deck cadets on campus on an average year, the resulting 173,760 annual assessments require a significant investment in time and manpower.

3.1 Assessing STCW tasks on the training ship

As stated previously, Cal Maritime has chosen to conduct all assessments of STCW competencies directly. The majority of the assessments are done on campus during the academic year, in the classroom, labs, on small craft, and in the full mission bridge simulator. The remaining 143 tasks are assessed aboard the Golden Bear. In all, 90 tasks are assessed for the third class cadets and 53 are conducted for the first class cadets (seniors). More will be discussed regarding these shipboard assessments later in the paper.

4. Training Program Overview

The annual training cruises on the United States Training Ship Golden Bear serve as a practical training platform and classroom for 340 deck students from Cal Maritime and the Texas Maritime Academy. The deck training program covers almost all aspects of a student’s learning experience aboard, and was designed by the Cal Maritime Department of Marine Transportation to require students to participate actively in all aspects of training necessary to obtain a level of competency and to successfully advance toward their degree and OICNW certification. With enrollments increasing and more stringent standards of training, certification and watch keeping for licensing of graduates, the department has been increasing the number of STCW assessments conducted onboard the Training Ship Golden Bear.

At the conclusion of a deck cadet’s third class cruise the student will possess the knowledge and skills consistent with an able bodied seaman (able seafarer deck). The student should be competent to stand watch as a helmsman and lookout, proficient in the training objectives of the practical, and navigation training programs, and adequately participate in shipboard maintenance projects.

Upon completion of the first class cruise period, students should be competent to stand watch as an officer in charge on a navigation watch, proficient in the training objectives of the entire training program, competent in celestial navigation, flashing light, and able to adequately supervise work projects and programs.

To account for the operations of the ship and to ensure efficient progression through their respective cruise training programs, the students are grouped by major (deck or engine) and class (third class or first class) and divided into divisions (e.g. 1 Deck – 1D, 2 Engine 2E, etc.). Each third and first class
deck division rotates through four activity cycles for a total of eight rotations of five days each. Students must pass all eight major rotations and embedded STCW assessments, as well as other ongoing requirements such as computer based training modules, exams and drills.

4.1 Shipboard training modules

To address the increasing numbers of Cal Maritime students and the ship sharing program with Texas Maritime Academy, the cruise period has been divided into two separate training periods of approximately 65 days each. Of those days, 43 days are set aside as at-sea training days. During the cruise students will spend approximately ten days on each of the following rotations: practical training, day work, bridge watch, and simulation/navigation training. To ensure students have the required knowledge and understanding of topics covered in a particular training module, students are required to review computer based training and complete a set of short exams.

4.2 Practical Training rotation

The third class Practical Training rotation is designed to introduce and reinforce various professional “on deck” knowledge and hands-on skill sets. Topics covered during this rotation include First Aid (Figure 2), Block and Tackle, Canvas Work, Firefighting, Ground Tackle, Knots, Bends, Hitches, Splicing, and Mooring. Fourteen Able Seafarer – Deck and Rating Forming Part of a Navigation Watch STCW assessments are also covered during this rotation to include mooring and anchoring, deck equipment, line handling, block and tackle and basic firefighting.

![Figure 2 First Aid Training aboard Golden Bear](image)

During the first class Practical Training rotation, cadets are training and assessed on Damage Control, Enclosed Space Entry, Fast Rescue Boat, Firefighting, Flashing Light/Morse Code, Mooring, Safety Inspections, and Survival Craft.

4.3 Watch rotation

The third class Watch rotation was designed to develop bridge familiarization, steering, and watch proficiency skills. There are four modules in this rotation which cover bridge watch as a helmsman and lookout, in port watch, security watch and safety watch. There are seventeen Able Seafarer – Deck and Rating Forming Part of a Navigation Watch STCW assessments accomplished in this rotation, fifteen covering helm and lookout duties and two covering environmental protection at sea and in port. The Watch rotation for the first class students is composed of seven modules covering at least three four hour bridge watches (Figure 3), a 1-day engineering familiarization watch, a communications and
meteorology watch, in port watches, a safety and security watch and at least one navigation watch. Thirteen OICNW STCW assessments are accomplished during this rotation.

4.4 Day Work rotation

Third class day work (Figure 4) consists of introduction in day-to-day shipboard operational and maintenance routines under supervision from first class cadets and ship’s officers. Structural maintenance, cleaning, lubrication of deck machinery and various other projects are undertaken as would be expected from an Ordinary Seaman (OS).

Through experiential learning, the third class day work rotation introduces students to the care and maintenance required to keep a sea-going vessel seaworthy. During this rotation emphasis is placed on personal safety, tool and equipment safety, product safety, and environmental safety. There are no STCW assessments conducted during this rotation.

Day work for the first class rotation is designed to develop practical proficiency in managing the vessel's deck student workforce accomplishing continued development of seamanship and other shipboard skills.
as expected of a ship’s officer. Once again, there are no STCW assessments performed during this rotation.

4.5 Simulation and Navigation Rotation

During this rotation, third class cadets are introduced to basic navigation and chart plotting techniques and utilize the onboard simulation facilities to learn Radar Plotting and Rules of the Road. In addition, they are assessed on several tasks from the Able Seafarer Deck and RFPNW tables.

As previously discussed, the pressure to accomplish more STCW assessments has significantly reduced the training to two days of radar followed by assessing Ratings Forming a Part of the Navigation Watch tables. The remaining days in the simulator are devoted to assessing lookout and helm duties along with anchor watch relief and detection and reporting of various bridge alarms. Because each cadet must be assessed individually a significant amount of time must be held aside to perform the assessment and any re-assessing that must follow.

The Simulation and Navigation rotation for the first class consists of five modules covering Radar Refresher, ECDIS, ARPA, license exam preparation and two full-mission bridge simulation exercises. Twenty three OICNW STCW assessments are conducted during this rotation.

The watchstanding simulation exercises in the FMB are of great benefit to the first class cadets. Because of the increasing numbers of cadets, the opportunities to stand watch on the bridge of the training ship are limited. And, in long ocean passages, several of those watches might be completed without seeing another vessel or changing course. The FMB exercises give each cadet extra opportunities for watchstanding involving piloting, maneuvering for collision avoidance, and VHF communication. The shipboard simulation capabilities of the Golden Bear will be further discussed in the following section.

5. Shipboard Simulation

In order to increase both the quantity and quality of training offered to the increasing number of cadets on the training ship, Cal Maritime constructed a multi-million dollar Navigation Laboratory (Nav Lab) onboard the Golden Bear [8]. (See Figure 5.) The Nav Lab on the ship contains a full-mission bridge (FMB) simulator and a part-task integrated bridge electronic systems trainer (IBEST). The FMB simulator, in the forward compartment of the Nav Lab, consists of an Integrated Navigation System and three display monitors. The IBEST, in the after compartment of the Nav Lab, consists of 10 simulation
stations that can be used to train up to 20 students on radar, automatic radar plotting aids (ARPA), electronic display and information systems (ECDIS), shiphandling and navigation.

5. Conclusion

Recent changes to STCW regulations have had a significant impact on the training program aboard the Golden Bear. As mentioned in the paper, the number of STCW assessments continues to grow along with national requirements which add additional complexity to course design and implementation. We continue to adapt the onboard training program to reflect these ever evolving requirements, but at what cost?

STCW was envisioned as a leveling mechanism to ensure professional competence is maintained throughout the world’s merchant fleets by setting a minimum standard of training and assessment. The elimination of license mills churning out dangerously unqualified mariners is one beneficial aspect of STCW. However, the process of ensuring our cadets meet the minimum STCW standards, much time and manpower is devoted to this endeavor and as courses are modified to accommodate STCW assessments, content must be reduced or eliminated. Time spent on traditional lecturing and experiential learning is increasingly being replaced with instruction on assessment topics and the subsequent time consumed assessing KUPs.

In order to ensure our cadets’ competence in all STCW KUPs, Cal Maritime does not accept STCW assessments conducted outside our institution. This is a benefit in that we can ensure that the assessments are of high quality and meet our academic standards. However, that also results in a larger administrative burden and comes at a cost of time available for direct instruction. While the majority of all STCW assessments are conducted ashore during the regular academic year, increasingly, in order to regain instructional time, there is pressure to incorporate more assessments into the at sea training program.

The training program aboard the Golden Bear has been designed to take advantage of the educational resources available on board including highly qualified maritime instructors, classrooms fitted with the latest educational technology, a library, computer based training and sophisticated simulators. This training program been adapted multiple times over the years and will continue to evolve to meet changing regulations, technology, and industry requirements.

References