

# Pilot Trainee

## Validation Report

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**Board of Pilot Commissioners  
For the Bays of San Francisco, San Pablo, and  
Suisun**



***Project Conducted by:***  
*Selection Services Program*  
*California Department of Human Resources*  
*August 2022*

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# **Validation Report**

**For the classification of**

**Pilot Trainee**

**Board of Pilot Commissioners  
For the Bays of San Francisco, San Pablo, and Suisun**

**August 2022**

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## INTRODUCTION

This report documents the development and validation of the selection process used to select Pilot Trainees into the Pilot Trainee Training Program (Training Program), as used by the Board of Pilot Commissioners (BOPC) for the Bays of San Francisco, San Pablo, and Suisun.

The process was specifically designed to comply with both the letter and spirit of equal employment opportunity laws and court precedents as well as the methodology acknowledged in the Federal *Uniform Guidelines on Employee Selection Procedures* and the Standards for Educational & Psychological Testing (American Educational Research Association, American Psychological Association, and the National Council on Measurement in Education, 1999). Subsequent sections of this report detail the specific procedures followed in order to develop a content-valid selection instrument.

## BACKGROUND AND PURPOSE

BOPC entered into a contractual agreement with the Selection Services Program (SSP) to develop a valid selection instrument for the Pilot Trainee position as used by BOPC. Examination development activities were based on and supported by the job analysis completed in November 2016. The intent of this report is to document the evidence of content validity for all selection procedures developed and used to select new Pilot Trainees into the Training Program.

Upon entering the Pilot Trainee program, the trainees begin hands-on training specifically tailored for the Pilot Trainee's background, skills, and needs. The initial pilot training program is one to three years. During this time, the Pilot Trainees perform their pilotage duties under careful supervision of veteran pilots on board working vessels in the various ports throughout the bays of San Francisco, San Pablo, and Suisun. Pilot Trainee performance on each trip is evaluated in writing as to the candidate's basic ship handling skills, knowledge of local waters, and ability to handle the requirements of the job. These evaluations are collected and reviewed by the Pilot Evaluation Committee before the pilot license is issued. Failure to meet any performance benchmark may result in a trainee being placed on probation.

## METHOD

Prior to examination development, to ensure that the examination reflected the actual tasks performed by San Francisco Bar Pilot Trainees, SSP analysts reviewed the 2016 job analysis with Bar Pilot SMEs to ensure the essential tasks and corresponding knowledge, skills, abilities, and personal characteristics (KSAPCs) identified in the job analysis were still critical to the job and expected at entry into the Pilot Trainee position. Examination development activities were based on a review of these job analysis results and the identification of those KSAPCs most appropriate for assessment. Documentation demonstrating the relationship between the job tasks and KSAPCs to the exam content is available in the appendix section of this report.

(See APPENDIX D for the Examination Item/KSAPC Linkage)

The Board's Pilot Evaluation Committee identified licensed, working pilots to provide subject matter expertise in interviews and focus groups to support exam development activities. These licensed pilots were consulted to identify the major subject matter areas and to develop the examinations. The participating pilots had varying degrees of experience ranging from newly licensed to very experienced. All individuals involved with examination development activities signed an examination security agreement which specified that they would keep all examination materials secure, discuss the examination only during Board-sponsored meetings, and avoid involvement in any examination-oriented review program for prospective pilot candidates. Signers included Pilot Evaluation Committee (PEC) members, staff at the California Maritime Academy, and pilots who served as subject matter experts (SMEs) in all phases of written, simulator, and structured interview examinations development scoring, and/or established the passing score for the written and simulator examinations.

Standardized procedures and protocols to administer all exam components were developed to ensure that every candidate had the same examination experience. These activities included:

- Conducted a job analysis study of the Bar Pilot Trainee to identify critical and expected upon entry knowledge, skills and abilities for testing purposes
- Developed detailed content specifications for the written examination
- Developed detailed content specifications for the simulator examination
- Developed detailed content specifications for the structured interview examination
- Developed multiple-choice questions based on the content specifications and job relatedness for new trainees
- Provided critical review of items by evaluating accuracy of the content and making editorial revisions
- Selected items for the published examination based on content specifications and SME feedback
- Evaluated scenarios and rating scales for the simulator examination for compliance with test and measurement principles
- Evaluated the standardized protocols that were developed to administer the simulator examination for compliance with test and measurement principles
- Developed structured interview questions to assess areas not covered by the written or simulator examination components
- Developed behavioral anchors to facilitate standardized scoring of the interview questions
- Facilitated the process for establishing criterion-referenced passing scores (modified Angoff) for written and simulator examinations
- Determined the passing scores for the written and simulator examinations
- Developed the ranked list of candidates based on their scores on all components of the examination

## **DEVELOPMENT OF EXAMINATION PLAN**

KSAPC statement were reviewed to determine which assessment methodology would be the most effective method of measurement. It is not uncommon for a KSAPC to be measurable using a variety of methods. For example, a person's ability to review information and take appropriate action may be measured using a written examination, a structured interview, or a job simulation activity, among other methods.

When considering the design of an appropriate selection procedure, it is strongly recommended that agencies consider using methods that might achieve their assessment goals while minimizing potential bias. Since most KSAPCs can be measured in a variety of ways, selecting the assessment technique that is the most effective for the broadest array of potential incumbents complies with the true spirit of anti-discrimination law.

SSP considers the variety of assessment procedures available when making the final recommendation to the agency in terms of the best approach for creating a valid and fair selection procedure. Issues considered included many pertinent variables such as administration resources, cost, efficiency, development resources, predictive validity of the various examination modalities, anticipated candidate pool size, vacancies to be filled, anticipated candidate characteristics, and job requirements to ensure that assessment modalities do not conflict with actual job requirements.

Upon consideration of all of the available information collected through this job analysis and examination development process, it was confirmed that the assessment procedures would consist of an Experience Evaluation, Written Examination, Simulator and a Structured Interview Examination.

## **DEVELOPMENT OF EXAMINATION PROCESS SCORING MODEL**

SSP project staff, in collaboration with the Bar Pilot Subject Matter Experts (SMEs), included as part of the examination development process a scoring model for the overall examination process for the Pilot Trainee position. The selection process consisted of three equally weighted components: experience, written examination and simulator examination. Through this process, it was determined that the scoring model would integrate all selection procedures in the following manner:

**Experience:** The process begins with a candidate application where they are tasked with demonstrating that they have sufficient experience to meet the requirements of 7 CCR, Division 2, Article 4, Subsection 213(e). The application is evaluated and those candidates who can establish proof of sufficient experience and other requirements are able to continue on in the examination process by sitting for the written examination. To sit for the written examination candidates must possess sufficient tug, deep draft, and/or piloting experience.

**Written Examination:** Candidates complete the Written Examination. A pass point for this examination was established with Bar Pilot SMEs post



examination administration. Candidates are required to pass the Written Examination in order to continue on in the examination process.

**Simulator Examination:** Candidates who passed the Written Examination would continue on to complete the Simulator Examination. In the bridge simulator examination, a variety of real-world complications and hazards are presented, and the candidates are evaluated on how well they handle unforeseen events. A separate pass point was established with Bar Pilot SMEs post examination administration.

**Structured Interview Examination:** Candidates who passed the Simulator Examination would continue on to complete the Structured Interview Examination. Candidates were presented with five structured interview questions they were expected to verbally respond to. The candidates were not given pre-exposure time to review the questions prior to providing his/her answer to the panel. Interview questions and behavioral anchors were developed with Bar Pilot SMEs.

The first three components (Experience, Written, Simulator) must be passed in order for the candidate to move on in the examination process. Final scores for all components (Experience, Written, Simulator, Interview) were weighted to ensure equal weight for each component, and then those weighed scores were added together to get the candidates' final overall score on the exam. The final overall scores were used to rank order candidates, thus allowing the commission to select individuals who scored the highest first into the Trainee Program, until the Board has exhausted the list of candidates.

## **DEVELOPMENT OF SELECTION PROCEDURES**

### **Written Examination:**

The decision was made to utilize the same examination questions that were used in the previous administration. These examination questions had already been developed, validated, and the pass point had been previously set. The exam development meetings for this section of the examination were held in 2019.

In 2019, five (5) examination development meetings were conducted to draft, review, finalize, and approve all content for the Written Examination as well as the BOPC's item bank. Exam items were renewed and referenced to current sources. The examination development meetings were convened on February 4-6, 2019, and February 25-26, 2019 were led by SSP project staff with the participation of several current and/or former Bar Pilots who served as SMEs. During these meetings, SMEs reviewed the Job Analysis data and confirmed the content areas to be assessed by the exam. SMEs and SSP then reviewed each established examination item to ensure the content corresponded with important and expected at entry KSAPCs and the difficulty level for all examination components were appropriate. The resulting final version of the examination was approved by the SMEs. Quality reviews of materials were



performed prior to administration.

The written examination consists of 150 multiple-choice items, with each item being weighted equally at one point. Questions on the written examination were distributed with respect to the weights of four subject matter areas: (1) pre-transit planning, (2) master/pilot transition, (3) route piloting, and (4) docking, undocking, & anchorage. Weights of subject matter areas were derived from job analysis results.

(See APPENDIX B for Written Examination Content Specifications)

### **Simulation Examination:**

Ten (10) meetings were conducted to develop the course and obstacles for the simulator examination. These meetings took place on the following dates in 2021: July 6, July 29-30, September 2, September 7, October 14-15, November 4, and November 8-9. Thirteen (13) examination development meetings were conducted to review, edit, finalize and approve all content for the Simulator Examination. The examination development meetings convened on the following dates in 2022: January 4, February 7, February 9, February 21, February 23, March 8-9, March 23, April 13, April 27, May 3, May 11, and May 18. The development of the Simulation Examination involved several SMEs who worked to coordinate, program, test, and validate the examination procedure and content. These SMEs included: a computer programmer (who is also an experienced mariner), a Coordinator who was a retired pilot, multiple active pilots, and CalHR staff. The Simulation Examination evaluates the candidates on the following seven subject matter areas: (1) situational awareness, (2) appropriate response, (3) ability to respond correctly under stress, (4) communication and bridge presence, (5) fundamental shiphandling, (6) bridge resource management, and (7) rules of the road. The number of measurement opportunities were distributed according to the weights of subject matter areas from the Job Analysis

The simulator's examination development process involved multiple repetitions of developing items, live testing with pilots, and revising content as necessary. Multiple revisions were necessary to ensure that nearly all of the possible actions that could be taken by candidates were identified and built into the system. The scoring system was designed around the metrics of +2 for highly effective, +1 for acceptable, 0 for ineffective, -1 for an allision (touching), and -2 for a collision/grounding. Evaluation forms were designed such that the candidates' evaluations were standardized. Numerous evaluation form revisions were necessary to achieve consensus regarding the wording, rating scales, and order of presentation of the measurement opportunities. Simulator raters were trained on the importance of ensuring the that the examination experience was consistent for each candidate. To support this, raters were briefed on the potential negative consequences associated with inconsistency (e.g., appeals, lawsuits, impact of unqualified candidates, negative press, candidate perceptions) and its impact on BOPC To ensure there were an adequate number of items developed to appropriately assess the skill of the candidates, 60 measurement opportunities were developed.

(See APPENDIX C for Simulation Examination Content Specifications)

### **Structured Interview Examination:**

Three (3) examination development meetings were conducted to develop the interview questions and scoring criteria. These meetings took place in the afternoon after simulator activities had been completed on the following dates: April 13, April 27, and May 11. In these meetings questions were developed and refined to ensure the wording and content of the questions were appropriate. Scoring criteria (behavioral anchors) were developed for each question individually. The interview utilized a 7-point scale, with a score of 1-2 considered not qualified, 3-5 considered qualified, and 6-7 considered well qualified.

(See APPENDIX A for Examination Panel SME Information)

## **PASS POINT SETTING**

The *Uniform Guidelines* require that the pass/fail cutoffs should be "...set so as to be reasonable and consistent with the normal expectations of acceptable proficiency in the workforce" (Section 5H). For licensing examinations, it is necessary to establish a passing score (cut score) based on the concept of minimal acceptable competence. The methodology most frequently applied, and which was used for all components in this examination process, is the Angoff method.

1. Select a representative sample SMEs who are truly experts in the content area and are diverse in terms of ethnicity, gender, geography, seniority (with a minimum of one year experience), and "functional areas" of the target position. Supervisors and trainers can also be included.
2. Facilitate a discussion with the SME panel to clarify and define the concept of a "minimally qualified applicant." The definition should be limited to an applicant who possesses the necessary, baseline levels of the KSAPC measured by the examination item to successfully perform the first day (before training) on the job.
3. Ask the SMEs to provide their ratings regarding probability of a minimally qualified applicant answering the examination item correctly.
4. Average the ratings across all SMEs for every item. Add these average ratings to establish the preliminary pass point.

The written and simulator assessments both require cut scores to be established. There are no predetermined standards to compare performance when determining if the standard set for passing is correct, or the number of points awarded for simulator activities is correct. Thus, SMEs were needed to establish appropriate pass points for both exam components. Participating SMEs provided their judgments based on training received from CalHR staff regarding Minimally Qualified Candidates, guidance from Bar Pilots with current and previous exam development and administration experience,

examinations' documentation, and their own expertise. CalHR staff, and Bar Pilots involved with exam development and administration activities, instructed SMEs to use their evaluative skills and to maintain consistent scoring principles for each candidate. While consensus amongst SME raters appears to be a necessary component for expert judgments, SME agreement does not guarantee correctness. Differences in ratings between the SMEs are likely a result of having different perspectives due to different settings or work experiences (e.g., deep sea versus inland piloting). SMEs were asked to be highly discriminating when setting the passing scores or performing evaluations and were reminded of the expectation to set pass points appropriate for the Bar Pilot Trainee level, rather than of an experienced, licensed Bar Pilot – the level of participating SMEs.

For the written examination component, there are 150 points possible. The Angoff method (as described above) was used to set the final pass point. Seven pilots, serving as SMEs, evaluated the exam items based on the performance expected of minimally competent trainees. After the SMEs received training in the Angoff process, they responded to the following question for each item "What percentage of minimally competent candidates (pilot trainees) would answer the item correctly?" The data was aggregated across all items and all raters and divided by seven, the number of SMEs. The results from the workshop established the passing score (cut score) at 106. The passing score was optimally established—the closest score above was 108 and the closest below was 100 which left clear gaps on both the pass and fail sides of the passing score.

For this simulator examination component, there are 120 points possible. The Angoff session for the simulator component included fourteen SMEs. Similar to the written examination, they received necessary training, and proceeded to provide their percentage of minimally acceptable candidates who would answer the item correctly. Data was again aggregated across all 60 items and divided by the number of participants. The final pass point was set to 55 points.

For the structured interview component, there were 105 points possible. The Behavioral anchors and scoring criteria were developed with SMEs on the dates mentioned above. The SMEs helped develop the scoring criteria by identifying suggested responses to each question and helping to develop the wording of the Behavioral Anchors. The Behavioral Anchors define the minimum expectations for candidate responses to each question and categorize those responses in "not qualified", "qualified", and "well qualified" categories.

(See APPENDIX D for Pass Point Data)

## PILOT TESTING

**Written Examination:** In order to maintain the security of the written examination, it was decided that the examination would not be piloted amongst SMEs. In lieu of a pilot test, the examination was evaluated by SMEs as part of a final review, and later reviewed again by CalHR staff to ensure examination quality. Such efforts, along with information

learned from frequent discussions with SMEs helped ensure: the clarity of instructions and exam items, and that previously established time limits remained appropriate for administration.

**Simulation Examination:** Piloting of the simulator component occurred throughout the exam development process, as participating examination raters and other invited SMEs were asked to complete the assessment activities for the exam development focus group to view and evaluate. The benefits of this pilot testing included: ensuring that the programming software was operating appropriately, observing the variables and responses involved as a candidate navigate throughout the examination and its items, ensuring the user-friendliness of tools (e.g., rating forms) developed for use by raters and exam proctors, ensuring the user-friendliness of candidate materials and instructions, establishing appropriate administration time limits, providing practice for raters to evaluate candidate and to determine how to rate newly identified observances, and other efforts to improve the overall quality of this component. Quality improvement modifications were consistently implemented as a result of these efforts.

**Structured Interview Examination:** Interview questions were presented to pilots who had assisted with pilot testing the simulator examination on May 11. This was done to ensure that the wording of the questions was clear and elicited responses as anticipated in the behavioral anchors. Slight changes in the wording of questions and the behavioral anchors resulted from the feedback we received from the SMEs involved in this process.

## RESULTS

**Experience Points:** BOPC staff evaluated 45 candidate applications and determined that 38 met or exceeded the minimum requirements to qualify for sitting for the written examination. In addition, some individuals were awarded points for their experience. Candidate scores ranged from 0 to 25 points. One candidate who was deemed qualified based on the minimum qualifications did not show for the written examination and was eliminated from contention.

**Written Examination:** Candidates were provided 4 ½ hours to complete the 150 multiple-choice item examination. The administration occurred in the California Maritime Academy's cafeteria, with candidates being seated at large round tables, two candidates to a table. The arrangement helped ensure that candidates were not able to observe other candidate's responses. Additionally, two versions of the written examination were administered to further deter candidate cheating. Of the 38 candidates who qualified to sit for the written exam, 37 appeared on the date of the exam with one no-show.

Of the 37 candidates who sat for the examination 27 successfully passed, enabling them to continue forward to take the Simulator examination component. The highest score on the written exam was 135 and the lowest score was 83. The mean score was 115.81 and the median score was 120.00.

**Simulation Examination:** The SMEs involved with examination development activities received extensive training and guidance for evaluating and scoring the candidates. For

training and practice purposes, the SME evaluators proceeded as if the person piloting the simulator was an actual pilot. Each evaluator first conducted their evaluation independently before convening to discuss results with other raters. These experiences helped confirm rater consistency and that no aspects included in the design of the simulation had a negative impact on candidates' performance.

The processes applied for training the evaluators involved during actual administration were quite similar to what occurred during administration. The evaluators observed and rated pilots during numerous dry runs until the evaluators were confident of the consistency of their evaluations. Evaluators were made aware of the consequences and impacts of their ratings by being reminded of two perspectives. The first necessity being that pilot trainees are expected to protect the public's health, safety and welfare. The second is the interest to ensure that the candidates are assessed fairly and consistently in the examination program and selection process, where each candidate has the same opportunity to succeed throughout the selections process. The evaluators included representation from BOPC's Pilot Evaluation Committee, state licensed pilots from another jurisdiction, and industry representatives with command experience on deep draft vessels.

The California Maritime Academy hosted the simulation examination on a full bridge simulator over three days, June 8<sup>th</sup>, 9<sup>th</sup>, and 10<sup>th</sup>, 2022. On the 8<sup>th</sup> the candidates who successfully passed the written examination were fully briefed on the process, received materials designed to assist in preparing for the examination which they were allowed to take from the site, received a hands-on orientation to the bridge, and observed the vessel's track through the simulation exercise.

All candidates were given a scheduled time to report to their simulator exercise. Each candidate was given 25 minutes prior to their simulator exercise to study materials relating to the exam in the map room at California Maritime Academy. This information included vessel transit information for the day in the bay where they were going to be transiting. There were six evaluators assigned to observe the candidates and participate in discussions of the candidate's performance based on the scoring criteria. Three evaluators would be assigned and responsible for evaluating each candidate. They were stationed in the simulator with the candidate so they could observe all candidate actions. A fourth evaluator was stationed in a room above the simulator where measuring equipment was used to determine measurements for certain items. After the simulation was completed, the three evaluators in the simulator conducted a "hot wash" session where they discussed the candidate's performance on each item based on the scoring criteria. The fourth evaluator provided the measurements for items that required it but was not involved in providing a final score for the candidate. The three evaluators would provide final scores for the candidate on each item based on their observations and the discussion with the other evaluators after the session. To obtain a final score for each candidate, the scores of the three evaluators were averaged for each item. To obtain a final score, the average scores for each of the 60 items were added together.

Similar to how the pass point was set for the written examination, an Angoff workshop was conducted with 12 SMEs who had been involved in the simulation. All evaluators



were intimately familiar with the exam content and the evaluation process. The evaluators have trained pilots enabling them to have an in-depth appreciation of the skill set needed by pilot trainees. They were asked to evaluate the level of performance that a minimally competent candidate would exhibit on each of the 60 measurement opportunities. They were asked to judge the level of performance based on the examination rating system, +2, +1, 0, -1, and -2. The mean score on the simulator was 48.51 and the median score was 49. The passing score was set at 55. Of the twenty-seven candidates who took the simulator exam, nine obtained a passing score according to scoring done on June 9<sup>th</sup> and 10<sup>th</sup>. One additional candidate was determined to have a passing score after a review of his simulator exercise on August 9<sup>th</sup>. The total number of candidates who passed the simulator examination was ten.

**Structured Interview:** The SMEs involved in assessing the structured interview were given training on the assessment items on June 15<sup>th</sup>. They reviewed each question as well as the expected responses and behavioral anchors. The questions and scoring criteria were discussed to ensure uniform understanding of all questions by all participants. Minor adjustments were made to the scoring criteria in certain places to ensure clarity of instructions.

Each of the ten candidates were given a time for their interview. The interview times were 1500 and 1600 on June 23<sup>rd</sup>, and 0700, 0800, 0900, 1000, 1100, 1230, and 1330 on June 24<sup>th</sup>. One candidate's interview was scheduled on August 26<sup>th</sup> at 0900. Due to candidates being spread across the country, all interviews were conducted via Microsoft Teams. Candidates were given 30 minutes to respond to the 5 questions. Prior to the interview the proctor of the interview read a script to all candidates. This script let them know the number of questions, the time limit of the interview, that the proctor could reread the questions but could not offer any other explanation regarding the questions, and that they could skip and/or return to any question at any time within their allotted 30 minutes. A timer counting down the 30 minutes was placed on a screen and the proctored confirmed each candidate could see the timer prior to beginning the interview.

The SMEs on the interview Panel introduced themselves at the beginning of the script and thanked the candidate at the end of the interview. Otherwise, there was no interaction between candidate and panel. The SMEs included three board members, one representing the Pilots, one public board member, and one industry board member. The panel took notes as the candidates responded to the five interview questions. They scored candidates on each of the five responses using a rating scale of 1-7 points. A score of 1-2 was considered not qualified for that question, a score of 3-5 was considered qualified, and a score of 6-7 was considered well qualified.

The scores of all three panel members were added up to reach an overall score for each question. Thus, the total score possible for the interview was 3 (panel members) times 5 (questions) times 7 (points) equaling 105 points possible on the exercise. The candidate's overall score for each question were added up for all five questions to get the candidates final score on the interview. The mean score on the interview was 73.40 and the median score was 72.

**Scaling:** The four components of the assessment process received equal weighting. With the total possible points varying for each exam component, it was necessary to scale the experience points and the simulation exercise points to be comparable to the maximum score achievable on the written examination. Thus, the maximum experience points, simulator scores, and interview scores were scaled to equal 150. The maximum amount of experience points was 90, which was scaled to equal 150, the maximum score achievable on the simulation exercise was 120, which was also scaled to equal 150, and the maximum score achievable on the interview was 105 which was also scaled to 150.

#### PROCESS FOR ESTABLISHING LISTING OF SUCCESSFUL CANDIDATES

The points awarded from each exam component were combined to establish the exam's total possible points. The first three components must be passed by the candidate to pass the exam overall. All four components were used to establish the final list of candidates. Candidates, who possessed sufficient qualifying experience and successfully passed the written and simulator components had their scores on all four components combined to determine their final rank order. The final scaled scores from all four components were added and candidates were ranked according to the total points earned. This allows the commission to select individuals who scored the highest first into the Trainee Program, until the Board has exhausted the list of candidates. The list was presented in a separate report to the BOPC.



## **APPENDIX A: Examination Panel Subject Matter Expert Participants**

### **Written Exam Development Meetings**

**Date: February 4, 5, and 6, 2019**

	<b>Name</b>	<b>Classification</b>	<b>Contact</b>
1	Tom Burger	Bar Pilot	
2	Randy Pinetti	Bar Pilot	
3	Steve Teague	Bar Pilot	
4	Larry Teague	Bar Pilot	

### **Written Exam Development Meetings**

**Date: February 25 and 26, 2019**

	<b>Name</b>	<b>Classification</b>	<b>Contact</b>
1	Tom Burger	Bar Pilot	
2	Pete McIsaac	Bar Pilot	
3	Steve Teague	Bar Pilot	
4	William Lemke	Bar Pilot	

### **Written Examination Angoff Session SMEs**

**Date: June 3, 2019**

	<b>Name</b>	<b>Classification</b>	<b>Contact</b>
1	Steve Teague	Bar Pilot	
2	John Carlier	Bar Pilot	
3	Jesse Pullin	Bar Pilot	
4	Kevin Freese	Bar Pilot	
5	Drew Aune	Bar Pilot	
6	Erik Fawcett	Bar Pilot	
7	Matt Lingo	Bar Pilot	

**Simulator Examination Development Meetings (Main Crew)**

**Dates: July 6, 29 & 30, September 2 & 7, October 14 & 15, November 4, 8, & 9, January 3, February 7 & 21, March 8, and May 3, 2022**

	<b>Name</b>	<b>Classification</b>	<b>Contact</b>
1	Eric Robinson	Bar Pilot	
2	Drew Aune	Bar Pilot	
3	Dustin Slack	Bar Pilot	
4	Shane Wehr	Bar Pilot	
5	Paul Ruff	Bar Pilot	
6	Allen Garfinkle	Ship Master	
7	J.D. Gates	Test Proctor with California Maritime Academy (CMA)	
8	Victor Schisler	Test Programmer, CMA	
9	Patrick Gonzales	Test Programmer, CMA	
10	Andrew Bowling	Test Programmer, CMA	

**Simulator Examination Development Meetings (Individual Simulation Runs)**

**Dates: January 4, February 9 & 23, March 9 & 23, April 13 & 27, May 11 & 18, 2022**

	<b>Name</b>	<b>Classification</b>	<b>Contact</b>
1	J Dan Murney	Bar Pilot	
2	Josh Stultz	Bar Pilot	
3	Kevin Freeze	Bar Pilot	
4	Nicholas Rogers	Bar Pilot	
5	Nick Deisher	Bar Pilot	
6	Chris Pyne-Mercier	Bar Pilot	
7	Dylan Epperson	Bar Pilot	
8	David Corbett	Bar Pilot	
9	Eric Fawcett	Bar Pilot	
10	Jason Vogel	Bar Pilot	

11	Eric Weber	Bar Pilot
12	Cevan LeSieur	Bar Pilot
13	Robert Carr	Bar Pilot
14	Zachary Kellerman	Bar Pilot
15	Will Benedict	Bar Pilot
16	Michael Rubino	Bar Pilot
17	Neil Billingsley	Bar Pilot
18	Matt Stevens	Bar Pilot
19	Mark Manes	Bar Pilot
20	David McCloy	Bar Pilot



**Structured Interview Examination Development Meetings  
April 13 & 27, and May 11, 2022**

	<b>Name</b>	<b>Classification</b>
1	Eric Robinson	Bar Pilot
2	Drew Aune	Bar Pilot
3	Dustin Slack	Bar Pilot
4	Shane Wehr	Bar Pilot
5	Paul Ruff	Bar Pilot
6	Allen Garfinkle	Ship Master
7	J.D. Gates	Test Proctor with California Maritime Academy (CMA)
8	Robert Carr	Bar Pilot
9	Anne McIntyre	Bar Pilot Board



### Simulator Examination Evaluators

Dates: June 8, 9, and 10, 2022

	Name	Classification	Contact
1	Drew Aune	Bar Pilot	
2	Dustin Slack	Bar Pilot	
3	Colleen Moran	Delaware Pilot	
4	Wendy Morrison	Galveston Pilot	
5	Chris Carson	Ship Master	
6	Tony Mocuin	Ship Master	

### Simulator Examination Angoff Session

Date: June 10, 2022

	Name	Classification	Contact
1	Drew Aune	Bar Pilot	
2	Dustin Slack	Bar Pilot	
3	Eric Robinson	Bar Pilot	
4	Shane Wehr	Bar Pilot	
5	Paul Ruff	Bar Pilot	
6	David McCloy	Bar Pilot	
7	Colleen Moran	Delaware Pilot	
8	Wendy Morrison	Galveston Pilot	
9	Chris Carson	Ship Master	
10	Tony Mocuin	Ship Master	
11	J.D. Gates	Test Proctor	
12	Allen Garfinkle	Ship Master	

**APPENDIX B Written Examination Content Specifications**Subject Matter Areas in Written Examination

SMEs worked as a group to evaluate and integrate task and KSAPC statements into four subject matter areas. Weights (percentages) to each area were based on the task ratings in the job analysis. Below is a table showing the four subject matter areas, area definitions, and weights.

<b>Subject Matter Area</b>	<b>Definition</b>	<b>Weight</b>
Pre-Transit Planning	Prepare for safe transit of vessel in a timely manner; determine feasibility of vessel movement	12%
Master-Pilot Transition	Exchange of information between master and pilot pertaining to transit; acclimate to vessel by analyzing equipment and vessel position	6%
Route Piloting	Take the conn; implement plans for safe transit of vessel from start to destination	44%
Docking, Undocking, & Anchorage	Initiate or terminate transit; approach or depart dock	38%

Written Examination Specifications

SSP utilized linkage data of job tasks and knowledge, skills, and abilities and personal characteristics (KSAPC) established by SMEs to organize KSAPC statements into Subject Matter Areas. The following tables represent the content specifications in the written examination. The specifications are organized in terms of Subject Matter Area and the KSAPCs that candidates must possess to perform job tasks. Each KSAPC, although linked to multiple job tasks, was listed only once to avoid redundancy.

CONTENT AREA	SUBAREA	ASSOCIATED KSAPC
I. Pre-Transit Planning (12%) – Prepare for safe transit of vessel in a timely manner; determine feasibility of vessel movement	A. Environment	<p>12 Knowledge of the effects of salinity on vessels' draft to allow for safe underkeel clearance.</p> <p>13 Knowledge of available resources (e.g., Army Corps charts, Local Notice to Mariners) to obtain latest channel depths and characteristics to ensure safe passage of vessels.</p> <p>14 Knowledge of available resources to determine predicted tides and currents to ensure timely transit.</p> <p>15 Knowledge of the effect of environmental factors on tide and current predictions to efficiently carry out transit operations.</p> <p>17 Knowledge of the effect of various environmental conditions on vessels' ability to ensure timely transit.</p>
	B. Geographic Conditions	<p>19 Knowledge of bridge clearances and configurations to avoid allision.</p> <p>20 Ability to identify and interpret information from charts to ensure safe transit.</p> <p>21 Knowledge of various types of port configurations and channels (e.g., turning basins, overhead structures) to ensure safe passage.</p>
	C. Vessel Capabilities	<p>24 Knowledge of the effect of vessel speed on squat, heel, and sinkage to determine safe and efficient transit.</p> <p>25 Knowledge of the effect of vessel's draft and trim on its handling to safely navigate through various water conditions.</p> <p>26 Knowledge of tugboat characteristics and bollard pull to determine tug effectiveness.</p> <p>27 Knowledge of the effect of environmental conditions on handling techniques of different classes of vessels to ensure safe transit.</p> <p>28 Knowledge of the effect of interactions between vessels in close quarters to prevent damage.</p> <p>29 Knowledge of various types of vessel maneuvering characteristics for effective shiphandling.</p>
	D. Transit Planning	<p>32 Ability to identify potential conflicts (e.g., vessel traffic, debris, current change, tide levels) on transit routes to ensure safe passage.</p> <p>34 Ability to coordinate meeting location, availability, et cetera with assigned tugboats for effective use.</p> <p>35 Knowledge of underkeel clearance, and its effect on the vessel in various locations along route, to ensure safe passage.</p>

CONTENT AREA	SUBAREA	ASSOCIATED KSAPC
II. Master-Pilot Transition (6%) – Exchange of information between master and pilot pertaining to transit; acclimate to vessel by analyzing equipment and vessel position.	A. Leadership/Supervision and Management	9 Knowledge of crew responsibilities on various vessels to carry out timely transit operations.
		8 Ability to coordinate and cooperate with Bridge Team to ensure effective transit operations.
		10 Ability to coordinate passing arrangements with other vessels with regards to your own vessel limitations.
	B. (Bridge and Vessel) Equipment	36 Knowledge of factors (e.g., environment, traffic, geographic conditions) that affect reliability of estimated times of arrival when meeting other vessels.
		37 Knowledge of various types of equipment (e.g., rudder, bitt [strength], thruster) necessary to ensure safe transit operations.
		38 Knowledge of use and limitations of various shipboard navigational equipment and radar systems for vessel maneuvering and collision avoidance.
	C. Communication	39 Ability to communicate in standard nautical terminology with shore-based support systems, bridge-to-bridge, and working channels to comply with protocols and procedures.
		40 Ability to communicate with Vessel Traffic Service to ensure safe navigation.
		43 Ability to read written documents of varying complexity including departmental policy, manuals, and guides to comprehend and communicate information to others.
	D. Vessel Characteristics	45 Knowledge of different tugboat characteristics to determine their suitability for specific tasks.
		47 Ability to interpret and interpolate draft mark readings to adjust shiphandling techniques accordingly.
		49 Ability to determine information about vessel maneuvering limitations, special requirements, and unusual characteristics to ensure effective shiphandling.



CONTENT AREA	SUBAREA	ASSOCIATED KSAPC
III. Route Piloting (44%) – Take the conn, implement plans for safe transit of vessel from start to destination	A. Technical	1 Knowledge of applicable guidelines or standards (e.g., Regulated Navigation Areas, speed limits, Rules of the Road, escort regulations) as they relate to maritime operations safety.
		2 Knowledge of shiphandling principles and methods to carry out safe and efficient transit operations.
		3 Knowledge of vessel movement operational guidelines to ensure compliance and safe piloting.
		4 Knowledge of the basic principles of physics (e.g., hydrodynamics) to assess the effect of external conditions on vessels and the vessels' effect on surroundings.
		5 Ability to operate specialized global positioning and tracking technology (e.g., Electronic Chart Display, Automatic Radar Plotting Aid) to ensure safe transit.
		6 Ability to read and interpret charts/soundings in order to determine conditions and navigate waterways safely.
		7 Ability to perform mathematical calculations (e.g., basic algebra) to effectively navigate vessels safely in various geographic and environmental conditions.
	B. Shiphandling	50 Ability to adjust maneuvering techniques based on vessel's type and size to ensure efficient shiphandling.
		52 Knowledge of hydrodynamic forces in narrow channels and shallow water to appropriately maneuver vessel in challenging conditions.
		53 Knowledge of vessel's wake effect to reduce negative effects on surrounding environments.
		56 Knowledge of the implications caused by vessels' speed relative to engine speed for effective shiphandling.
		54 Ability to properly maneuver the vessel under changing channel configurations to ensure safe passage.
		55 Ability to safely handle the vessel depending on changing vessel factors (e.g., underkeel clearance, heel) for effective maneuvering.
	C. Traffic Management	57 Knowledge of factors that affect pivot point to adjust shiphandling.
		59 Knowledge of factors (e.g., weather, traffic, geographic conditions) constraining other vessels' transit to plan transit operations accordingly.
		61 Knowledge of water depths and configurations in bays, channels, rivers, harbors, and anchorages, and their effects on navigation to manage transit planning accordingly.
	D. Situational Awareness	62 Ability to properly apply Rules of the Road and/or Vessel Traffic Service regulations to ensure safe transit.
		75 Ability to strategize and prioritize information from multiple sources to carry out transit operations in a timely manner.
		76 Ability to perform multiple tasks simultaneously when responding to unfolding events

		<p>to ensure a safe transit.</p> <p>77 Ability to adapt to sudden changing conditions (e.g., environmental, mechanical) in order to ensure vessel safety.</p> <p>78 Ability to observe actions and/or response of others to ensure compliance with orders.</p> <p>79 Ability to follow up with others (e.g., personnel, vessels) to ensure predetermined arrangements are carried out.</p> <p>80 Ability to choose and take the appropriate course of action to mitigate an unforeseen event or hazard.</p> <p>81 Ability to apply past experiences to present or future circumstances to ensure mistakes are not repeated.</p> <p>82 Ability to assess crew's effectiveness in responding to pilot's orders to ensure safe vessel transit.</p>
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CONTENT AREA	SUBAREA	ASSOCIATED KSAPC
IV. Docking, Undocking, & Anchorage (38%) – Initiate or terminate transit; approach or depart dock.	A. Anchorage	<p>63 Knowledge of factors that affect anchoring of a vessel to ensure its safety.</p> <p>65 Ability to assess potential hazards at local anchorages to ensure safety of vessel.</p> <p>66 Ability to carry out anchoring procedures while vessel is moving, mooring, or in emergency situations to ensure vessel safety.</p> <p>67 Knowledge of various navigation techniques to precisely anchor a vessel under various conditions.</p>
	B. Docking and Undocking	<p>68 Knowledge of acceptable protocol and etiquette for radio communication to ensure proper docking and undocking of vessel.</p> <p>69 Knowledge of the effect of existing traffic conditions on departure/arrival times to ensure safe transit.</p> <p>70 Knowledge of capabilities and limitations of different types of tugboats to safely dock and undock the vessel.</p> <p>73 Knowledge of various methods to determine distances, speed, and position of own vessel and of vessels in close proximity.</p> <p>74 Knowledge of environmental conditions (e.g., current, wind) for approach to berth in order to safely dock and undock vessel.</p>

## APPENDIX C: Simulation Examination Content Specifications

### Subject Matter Areas in Simulation Examination

SMEs worked as a group to determine which tasks were to be measured in simulation examination. Definitions for the seven subject matter areas in the simulation examination are as follows:

- 1) **Situation awareness:** Assesses the candidate's appreciation of the situation the vessel is in at all times during the exercise including relative motion, traffic, aids to navigation, effect of wind, current and other forces on the vessel, and the candidate's ability to accurately filter and prioritize available information.
- 2) **Appropriate response:** Assesses the candidate's responses in routine transit, including timeliness and appropriateness of rudder commands, engine orders and other orders to the bridge team.
- 3) **Ability to respond correctly under pressure:** Separately assess the candidate's ability to respond under emergency or non-routine situations of increased stress.
- 4) **Communication and bridge presence:** Assesses the candidate's ability to use concise, clear, and pertinent communications using proper terminology on radios, with the bridge, and evaluation teams. In addition, assesses the candidate's professional composure, demeanor, and ability to communicate warranted self-confidence, which inspires confidence in the bridge team that the vessel's navigation is in good hands.
- 5) **Fundamental ship handling:** Assesses the candidate's knowledge of proper and timely use of engine and rudder commands and understanding the ship's response to those commands.
- 6) **Bridge resource management:** Assesses the candidate's proper use of all personnel and equipment resources available during the exercise.
- 7) **Rules of the road:** assesses the candidate's proper application of the navigational rules of the road to the situations presented. The Inland Rules will apply throughout this exercise.

### Simulation Examination Specifications

Tasks selected for the simulation examination were derived from the job analysis which SMEs identified as critical tasks for successful job performance. The Simulator Examination Specification matrices on the following pages represent how SMEs categorized each job task per Subject Matter Area to allow for measurement opportunities in the Simulator Examination.

### Simulator Measurement Opportunities

The table below shows the weight of each Subject Matter Areas and corresponding measurement opportunities in the Simulator Examination. Weighting was computed by taking the total number of tasks within a Subject Matter Area and divide by the sum of all tasks within the seven Subject Matter Areas.

Subject Matter Area	Tasks	Weight	Measurement Opportunities
Situation awareness	19	18%	11
Appropriate response	21	20%	12
Ability to respond correctly under pressure	22	21%	12
Communication and bridge presence	10	9%	6
Fundamental ship handling:	22	21%	12
Bridge resource management	7	7%	4
Rules of the road	5	5%	3
<b>TOTAL</b>	<b>106</b>	<b>100%</b>	<b>60</b>

## I. Pre-Transit Planning

Tasks		Situation Awareness	Appropriate Responses	Respond Under Stress	Communication and Bridge Presence	Fundamental Ship Handling	Bridge Resource Management	Rules of the Road
1	Determine factors (e.g., weather, traffic, underkeel clearances, tugboat availability) affecting the desired route or alternative route to plan safe transit routes accordingly.	x	x			x		
4	Calculate underkeel clearances by reviewing channel sounding charts and local area data for vessel safety.				x		x	
5	Calculate overhead clearances based on height of tide at locations along route to ensure safe and uneventful transit.	x	x		x	x		
10	Identify constraints on vessel maneuverability based on vessel factors (e.g., type, draft, air draft, vessel particulars) to plan efficient transit routes.		x			x		
14	Develop a personal, standardized conference practice with Master to effectively execute Master-Pilot exchange.				x		x	

## II. Master-Pilot Transition

Tasks		Situation Awareness	Appropriate Responses	Respond Under Stress	Communication and Bridge Presence	Fundamental Ship Handling	Bridge Resource Management	Rules of the Road
15	Exchange information (e.g., pilot card, tug escort form) with Master to determine vessels' handling characteristics and readiness for emergency situations.		x	x		x	x	
16	Communicate with Master regarding existing underkeel clearance, traffic, and environmental conditions to ensure departure/arrival times are feasible.	x	x		x			x
19	Establish radio communication with Vessel Traffic Service to report vessel location and destination, and to receive information about other vessel movements.		x	x	x			x

### III. Route Piloting

Tasks		Situation Awareness	Appropriate Responses	Respond Under Stress	Communication and Bridge Presence	Fundamental Ship Handling	Bridge Resource Management	Rules of the Road
2	Evaluate environmental conditions to determine, and adjust accordingly, appropriate vessel operations (e.g., transit, maneuvering) in compliance with Vessel Traffic Service safety regulations.	x	x	x		x		
3	Review timely navigational information to evaluate risks posed by unusual factors and/or special circumstances that may affect vessel movement.		x		x	x		
6	Adjust to bridge environment and layout in order to carry out safe transit operations.		x	x		x	x	
7	Monitor environmental and traffic conditions to appropriately update estimated arrival times.	x	x	x		x		
12	Plan transit routes by evaluating traffic conditions to ensure vessel safety.		x	x		x	x	
13	Determine current at locations (e.g., along planned route, at berth) to develop plans for maneuvering vessel.	x	x			x		
17	Maintain communication with Bridge Resource Team to ensure free flow of information.		x	x	x			
18	Communicate with Marine Exchange when checking in with escorted vessels to comply with California State regulations.				x			
20	Communicate with other vessels in a timely manner to make passing arrangements and ensure the safety of vessels.		x	x		x		x
21	Communicate time of arrival with Lift Bridge Operator to arrange safe and timely transits.	x	x	x		x		
25	Monitor Vessel Traffic Service and radio communications to determine traffic conditions and ensure vessel safety.	x	x					x
32	Determine the relative motion of other craft on the water to assess the risk of collision.	x		x		x		x
33	Utilize navigational equipment (e.g., radar, Electronic Chart Display) to determine information regarding vessels' transit (e.g., position, course, speed).	x	x		x		x	
34	Assess potential risk caused by vessel transit to minimize harm to property, persons, and the environment.	x	x	x		x	x	

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35	Determine vessels' clearance from objects in close proximity through all available means to avoid collisions/allisions.	x					x	
40	Prioritize actions during transit to ensure essential operations are carried out in a timely manner.	x	x	x				
41	Perform multiple tasks simultaneously when responding to unfolding events to ensure a safe transit.	x	x	x				
43	Observe actions and/or response of others to ensure compliance with orders.	x	x	x	x			
44	Follow up with others (e.g., personnel, vessels) to ensure predetermined arrangements are carried out.	x	x		x			
46	Maintain awareness of current situation when interrupted by events to ensure vessel safety and necessary actions are completed.	x	x	x		x		

#### IV. Docking, Undocking, & Anchorage

Tasks		Situation Awareness	Appropriate Responses	Respond Under Stress	Communication and Bridge Presence	Fundamental Ship Handling	Bridge Resource Management	Rules of the Road
8	Assess immediate navigation and traffic conditions to identify potential hazards to vessel.	x	x	x		x		
9	Assess dock and berth characteristics to avoid potential obstructions.		x			x		
11	Modify transit plan due to vessel responsiveness, traffic/berth conflicts, or environmental conditions for efficient transit operations.	x	x	x		x		
22	Coordinate with Master and Bridge Resource Team to ensure timely availability of crew for anchoring, mooring or other evolutions.		x	x	x		x	
23	Establish working radio communication frequencies to facilitate communication with other vessels and/or tugboats.	x	x			x		
24	Communicate with Master regarding line handling and docking plan to ensure appropriate actions are being taken.		x	x	x		x	
26	Determine the vessel's responsiveness to changes in course/speed and environmental conditions to ensure safe and effective maneuvering.	x				x		



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Pilot Trainee

27	Observe vessel's response to helm and engine orders to ensure safe and timely maneuvering.	x				x		
28	Take corrective actions (e.g., rerouting, speed adjustment) to ensure vessel arrives at predetermined points in an appropriate manner.	x	x	x		x		
29	Position vessel for approach to berth to ensure vessel docks safely.	x	x	x		x		
30	Maneuver vessel while ensuring safety of tugboats, vessel, and terminal facilities during transit and undocking/docking operations.	x	x	x		x		
31	Control vessel at an appropriate speed when in transit and/or approach to berth or anchorage to ensure vessel safety.	x	x	x		x		
36	Position vessel alongside berth to ensure safe cargo operations.	x	x		x	x		
37	Monitor line handling that may affect ship personnel, equipment, or facility to ensure effective mooring and unmooring.	x		x	x			
38	Anchor vessel in appropriate locations to ensure safety and compliance with vessel traffic regulations.	x	x	x		x		x
39	Ensure final mooring arrangement is sufficient for prevailing conditions to ensure vessel is safely moored.	x	x				x	
42	Adapt to sudden changing conditions (e.g., environmental, mechanical) in order to ensure vessel safety.	x	x	x		x		
45	Choose and take the appropriate course of action to mitigate an unforeseen event or hazard.	x	x	x		x		

## APPENDIX D: Examination Item/KSAPC Linkage

### Written Examination Item Linkage

Exam Item #	KSAPC #
1	1, 6, 7, 8, 9, 13, 14, 35, 43, 47, 79, 82
2	4, 6, 12, 17, 24, 25, 52, 55
3	2, 5, 6, 19, 32, 38, 65, 67, 77, 80, 81
4	2, 4, 29, 49, 56, 57, 63, 66, 75, 76
5	2, 4, 26, 28, 37, 45, 68, 70, 77, 78, 79
6	2, 3, 4, 26, 70, 73, 74
7	2, 27, 29, 49, 50, 56
8	2, 4, 7, 24, 25, 27, 29, 35, 49, 50, 52, 54, 55, 56, 57, 67
9	2, 4, 5, 15, 17, 19, 25, 27, 29, 36, 38, 47, 49, 50, 52, 54, 55, 59, 73, 74, 77, 80, 81, 82,
10	2, 5, 6, 19, 32, 38, 65, 67, 77, 80, 81
11	2, 4, 10, 24, 25, 27, 29, 35, 52, 54, 55, 56, 61
12	2, 4, 8, 29, 37, 49, 50, 54, 56, 57, 75, 80, 81, 82
13	6, 13, 20, 21, 32, 61
14	4, 24, 25, 29, 55, 61, 77
15	2, 4, 29, 37, 49, 50, 55, 56, 57, 63, 80, 81
16	6, 13, 20, 21, 32, 35, 63, 65, 67
17	6, 13, 14, 20
18	2, 4, 12, 13, 15, 17, 24, 25, 35
19	2, 4, 29, 49, 73, 74, 77
20	2, 4, 25, 27, 29, 49, 50, 57, 74
21	2, 4, 6, 7, 8, 9, 13, 15, 20, 21, 27, 37, 49, 52, 56, 57, 61, 63, 66, 75, 76, 77, 78, 79, 82
22	2, 4, 10, 24, 25, 27, 29, 35, 52, 54, 55, 56, 61
23	4, 12, 24, 25, 52, 56, 77
24	4, 52, 54, 55, 76, 77, 80
25	2, 4, 10, 24, 25, 27, 29, 35, 52, 54, 55, 56, 61
26	2, 4, 26, 28, 37, 45, 68, 70, 77, 78, 79
27	2, 4, 8, 15, 25, 27, 29, 37, 47, 49, 50, 52, 54, 55, 57, 74, 76, 78, 82
28	1, 6, 8, 9, 13, 14, 15, 32, 37, 38, 43, 59, 61, 73, 78, 79, 82
29	1, 6, 7, 20, 47
30	2, 4, 7, 24, 25, 27, 36, 49, 50, 52, 55, 56, 57, 61
31	2, 4, 5, 15, 27, 38, 52, 75, 76, 81, 49, 50, 55, 59, 61
32	2, 4, 6, 7, 15, 20, 21, 24, 25, 27, 28, 29, 32, 35, 36, 49, 50, 52, 53, 54, 55, 56, 59, 61, 76, 78, 80, 81, 82
33	2, 4, 29, 49, 56, 57, 63, 66, 75, 76
34	2, 4, 6, 8, 9, 13, 14, 21, 37, 49, 52, 57, 61, 63, 66, 76, 77, 78, 79, 80, 82
35	2, 4, 7, 15, 27, 32, 36, 59, 74

Exam Item #	KSAPC #
36	38,75,49
37	4, 12, 24, 25, 52, 56, 77
38	2, 4, 5, 7, 21, 26, 28, 29, 32, 34, 38, 47, 52, 53, 56, 57, 63, 67, 74, 75, 76, 77, 78, 79, 81, 82
39	2, 4, 26, 29, 37, 45, 49, 50, 70
40	2, 5, 6, 7, 63, 67
41	4, 25, 45, 55, 57
42	2, 4, 29, 37, 49, 56
43	6, 15, 20, 35, 61, 65
44	2, 4, 7, 17, 26, 37, 38, 47, 56, 57, 74, 76, 77, 79, 80, 81
45	15, 20, 27, 50, 54, 55, 61, 75, 77, 81
46	2, 5, 6, 7, 63, 67
47	2, 4, 25, 28, 32, 35, 52, 54, 53, 56, 80
48	2, 4, 6, 7, 15, 20, 21, 24, 25, 28, 29, 32, 35, 52, 53, 56, 76, 78, 80, 81, 82
49	2, 4, 7, 24, 25, 27, 36, 49, 50, 52, 55, 56, 57, 61
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51	2, 4, 24, 25, 27, 28, 29, 31
52	2, 4, 29, 52, 54, 55, 56, 57, 66, 80, 81
53	2, 4, 6, 9, 15, 20, 27, 29, 32, 35, 49, 50, 52, 54, 55, 56, 57, 75, 76, 77, 78, 79, 80, 81, 82
54	6, 7, 13, 19, 20, 31, 32
55	2, 4, 25, 27, 29, 49, 50, 57, 74
56	2, 4, 8, 9, 25, 29, 31, 49, 66, 78, 79, 80
57	2, 4, 26, 28, 37, 45, 68, 70, 77, 78, 79
58	2, 4, 6, 8, 9, 13, 14, 21, 37, 49, 52, 57, 61, 63, 66, 76, 77, 78, 79, 80, 82
59	2, 4, 37
60	2, 37
61	2, 4, 17, 27, 56, 57
62	4, 37
63	2, 27, 29, 49, 50, 56
64	2, 4, 14, 15, 26, 27, 29, 37, 45, 49, 50, 57, 70, 74, 78
65	2, 4, 6, 7, 8, 9, 13, 15, 20, 21, 27, 37, 49, 52, 56, 57, 61, 63, 66, 75, 76, 77, 78, 79, 82
66	2, 4, 24, 26, 29, 37, 45, 49, 50, 57, 70, 75, 78
67	2, 4, 10, 24, 25, 27, 29, 35, 52, 54, 55, 56, 61
68	2, 4, 7, 24, 25, 29, 35, 52, 56, 57, 67, 27, 49, 50, 54, 55, 61
69	4, 37
70	2, 4, 26, 28, 37, 45, 68, 70, 77, 78, 79
71	6, 7, 47, 63, 66, 67
72	2, 4, 7, 24, 25, 27, 29, 35, 49, 50, 52, 54, 55, 56, 57, 61, 67
73	2, 4, 29, 37, 50, 52, 55
74	2, 3, 4, 24, 27, 55

Exam Item #	KSAPC #
75	2, 4, 37
76	2, 4, 24, 26, 28, 45, 56
77	2, 4, 6, 13, 15, 27, 29, 35, 49, 50, 54, 55, 56, 57, 61, 63, 65, 66, 67, 75, 76, 77, 78, 79, 81, 82
78	7, 49, 73, 74
79	2, 4, 6, 7, 8, 9, 13, 15, 20, 21, 27, 37, 49, 52, 56, 57, 61, 63, 66, 75, 76, 77, 78, 79, 82
80	2, 4, 7, 15, 27, 32, 36, 59, 74
81	2, 4, 7, 37, 56, 57, 74, 79
82	2, 4, 29, 49, 56, 57, 63, 66, 75, 76
83	2, 4, 24, 26, 29, 37, 45, 49, 50, 57, 70, 75, 78
84	2, 4, 29, 49, 56, 57, 63, 66, 75, 76
85	2, 4, 6, 9, 20, 15, 27, 29, 32, 35, 49, 50, 52, 54, 55, 56, 57, 61, 75, 76, 77, 78, 79, 80, 81, 82
86	2, 4, 21, 50, 52, 56, 57, 61, 73, 74, 80, 81
87	2, 4, 25, 29, 47, 56
88	2, 4, 24, 26, 28, 45, 56
89	2, 4, 10, 24, 25, 27, 29, 35, 52, 54, 55, 56, 61
90	7, 47
91	2, 4, 29, 37, 57, 49, 50
92	2, 4, 8, 9, 15, 21, 27, 29, 35, 49, 50, 55, 56, 57, 61, 66, 74, 78, 82
93	2, 4, 6, 7, 8, 9, 13, 15, 20, 21, 27, 37, 49, 52, 56, 57, 61, 63, 66, 75, 76, 77, 78, 79, 82
94	2, 4, 25, 27, 29, 49, 50, 57, 74
95	2, 4, 8, 9, 15, 27, 37, 39, 52, 61, 68, 74, 75, 78, 79
96	2, 4, 10, 24, 25, 27, 29, 35, 52, 54, 55, 56, 61
97	2, 4, 7, 24, 52, 50
98	2, 4, 7, 24, 25, 28, 29, 36, 49, 50, 52, 55, 56, 80, 81
99	2, 27, 29, 49, 50, 56
100	7, 27, 59, 74, 77
101	2, 4, 29, 27, 49, 50, 55
102	2, 4, 24, 25, 27, 28, 29, 31
103	2, 4, 24, 25, 27, 28, 29, 31
104	2, 4, 25, 27, 29, 49, 50, 57, 74
105	4, 15, 21, 27, 49, 54, 74, 77
106	2, 4, 10, 24, 25, 27, 28, 29, 34, 35, 36, 37, 49, 50, 52, 54, 55, 56, 61, 76, 77, 78, 79, 80, 81, 82
107	2, 4, 6, 17, 25, 27
108	2, 4, 5, 15, 17, 19, 25, 27, 29, 36, 38, 47, 49, 50, 52, 54, 55, 59, 73, 74, 77, 80, 81, 82
109	5, 38, 73
110	2, 4, 6, 7, 12, 14, 17, 20, 21, 24, 25, 28, 29, 32, 35, 52, 53, 56, 80, 81

Exam Item #	KSAPC #
111	4, 15, 21, 27, 49, 54, 74, 77
112	5, 38, 73
113	2, 4, 5, 15, 17, 19, 25, 27, 29, 36, 38, 47, 49, 50, 52, 54, 55, 59, 73, 74, 77, 80, 81, 82
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115	2, 37, 38
116	2, 4, 10, 24, 25, 27, 28, 29, 34, 35, 36, 37, 49, 50, 52, 54, 55, 56, 61, 76, 77, 78, 79, 80, 81, 82
117	2, 4, 7, 37, 56, 57, 74, 79
118	2, 4, 25, 27, 29, 49, 50, 57, 74
119	2, 4, 8, 9, 13, 14, 20, 21, 25, 35, 37, 57, 61, 63, 66, 75, 78
120	2, 4, 24, 26, 29, 37, 45, 49, 50, 57, 70, 75, 78
121	7, 49, 73, 74
122	2, 4, 24, 26, 29, 37, 45, 49, 50, 57, 70, 75, 78
123	1, 2, 3, 6, 9, 75
124	2, 4, 24, 25, 29, 35, 47, 49, 50, 52, 55, 56, 57, 67, 81
125	2, 4, 5, 15, 27, 38, 49, 50, 52, 55, 59, 61, 75, 76, 81
126	2, 4, 10, 24, 25, 27, 29, 35, 52, 54, 55, 56, 61
127	2, 4, 14, 24, 25, 29, 35, 37, 52, 56, 57, 76, 78, 79, 81, 82
128	2, 4, 7, 24, 25, 27, 29, 35, 49, 50, 52, 54, 55, 56, 57, 61, 67
129	2, 4, 7, 14, 15, 17
130	2, 4, 8, 9, 15, 21, 27, 29, 35, 49, 50, 55, 56, 57, 61, 66, 74, 78, 82
131	2, 4, 12, 13, 15, 17, 24, 25, 35
132	2, 4, 29, 37, 57
133	4, 37
134	2, 4, 8, 15, 25, 27, 29, 37, 47, 49, 50, 52, 54, 55, 57, 74, 76, 78, 82
135	2, 4, 7, 24, 25, 27, 29, 35, 49, 50, 52, 54, 55, 56, 57, 61, 67
136	2, 4, 7, 10, 14, 15, 17, 20, 21, 24, 27, 28, 32, 52, 54, 56, 61, 74, 77, 81
137	4, 7, 15, 27, 36, 50, 57, 59, 63, 67, 74, 77
138	2, 4, 6, 7, 8, 9, 13, 15, 20, 21, 27, 37, 49, 52, 56, 57, 61, 63, 66, 75, 76, 77, 78, 79, 82
139	2, 4, 25, 27, 29, 49, 50, 57, 74
140	2, 4, 6, 7, 8, 9, 13, 15, 20, 21, 27, 37, 49, 52, 56, 57, 61, 63, 66, 75, 76, 77, 78, 79, 82
141	2, 4, 29, 37, 49, 52, 56
142	15, 17, 27, 38, 59, 77
143	1, 2, 3, 6, 9, 75
144	2, 4, 7, 24, 25, 27, 29, 35, 49, 50, 52, 54, 55, 56, 57, 61, 67
145	2, 8, 37, 43, 49, 50, 75
146	2, 4, 5, 7, 9, 15, 21, 26, 27, 28, 29, 32, 34, 36, 38, 47, 49, 50, 52, 53, 56, 57, 59, 61, 63, 65, 66, 67, 74, 75, 76, 77, 78, 79, 81, 82

Exam Item #	KSAPC #
147	2, 3, 4, 7, 6, 12, 13, 14, 15, 17, 19, 20, 24, 25, 27, 32, 35, 36, 47, 55, 61, 74, 77, 80, 81
148	2, 4, 27, 35, 52, 55, 56, 61
149	1, 2, 3, 5, 6, 7, 8, 9, 10, 12, 13, 14, 17, 19, 20, 21, 24, 25, 26, 27, 29, 32, 34, 35, 36, 37, 38, 39, 40, 43, 45, 47, 49, 50, 52, 53, 54, 55, 56, 57, 59, 61, 62, 63, 65, 67, 68, 69, 70, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87
150	6, 7, 47, 63, 66, 67

### Simulator Examination Item Linkage

Exam Item #	Task #
1	2, 10, 11, 12, 13, 15, 22, 40, 41, 42, 43, 44, 45, 46
2	12, 15, 33, 34, 46
3	2, 3, 6, 7, 12, 13, 26, 27, 28, 30, 31, 32, 33, 34, 35, 41, 46
4	1, 2, 7, 8, 11, 12, 20, 23
5	2, 3, 6, 7, 12, 13, 26, 27, 28, 30, 31, 32, 33, 34, 35, 41, 46
6	2, 3, 6, 7, 12, 13, 26, 27, 28, 30, 31, 32, 33, 34, 35, 41, 46
7	2, 6, 12, 17, 20, 32, 34, 40, 41, 43, 46
8	1, 2, 3, 4, 5, 6, 8, 10, 11, 12, 17, 33, 34, 35, 40, 41, 42
9	2, 6, 12, 17, 20, 32, 34, 40, 41, 43, 46
10	26, 27, 28, 29
11	1, 2, 7, 8, 11, 12, 20, 23
12	1, 2, 7, 8, 11, 12, 20, 23
13	26, 27, 28, 29
14	2, 3, 6, 7, 12, 13, 26, 27, 28, 30, 31, 32, 33, 34, 35, 41, 46
15	1, 2, 7, 8, 11, 12, 20, 23
16	2, 3, 6, 7, 12, 13, 26, 27, 28, 30, 31, 32, 33, 34, 35, 41, 46
17	2, 3, 6, 7, 12, 13, 26, 27, 28, 30, 31, 32, 33, 34, 35, 41, 46
18	2, 6, 12, 17, 20, 32, 34, 40, 41, 43, 46
19	2, 3, 6, 7, 12, 13, 26, 27, 28, 30, 31, 32, 33, 34, 35, 41, 46
20	2, 6, 12, 17, 20, 32, 34, 40, 41, 43, 46
21	2, 3, 6, 7, 12, 13, 26, 27, 28, 30, 31, 32, 33, 34, 35, 41, 46
22	2, 6, 12, 17, 20, 32, 34, 40, 41, 43, 46
23	1, 2, 7, 8, 11, 12, 20, 23
24	1, 2, 7, 8, 11, 12, 20, 23
25	1, 2, 3, 5, 8, 10, 11, 12, 17
26	26, 27, 28, 29
27	2, 3, 6, 7, 12, 13, 26, 27, 28, 30, 31, 32, 33, 34, 35, 41, 46
28	1, 2, 6, 8, 10, 17, 33, 41, 42, 45
29	2, 6, 12, 17, 20, 32, 34, 40, 41, 43, 46
30	1, 2, 7, 8, 11, 12, 20, 23
31	2, 3, 6, 7, 12, 13, 26, 27, 28, 30, 31, 32, 33, 34, 35, 41, 46
32	2, 6, 12, 17, 20, 32, 34, 40, 41, 43, 46
33	1, 2, 7, 8, 11, 12, 20, 23
34	1, 2, 7, 8, 11, 12, 20, 23
35	1, 2, 7, 8, 11, 12, 20, 23
36	2, 3, 6, 7, 12, 13, 26, 27, 28, 30, 31, 32, 33, 34, 35, 41, 46
37	2, 6, 12, 17, 20, 32, 34, 40, 41, 43, 46
38	2, 3, 6, 7, 12, 13, 26, 27, 28, 30, 31, 32, 33, 34, 35, 41, 46
39	1, 2, 7, 8, 11, 12, 20, 23



Exam Item #	Task #
40	2, 3, 6, 7, 12, 13, 26, 27, 28, 30, 31, 32, 33, 34, 35, 41, 46
41	1, 2, 3, 17, 33, 40, 41, 42, 45
42	1, 2, 3, 17, 33, 40, 41, 42, 45
43	1, 2, 11, 16, 17, 18, 19
44	1, 4, 6, 12, 33, 34, 35
45	1, 2, 7, 8, 11, 12, 20, 23
46	2, 3, 6, 7, 12, 13, 26, 27, 28, 30, 31, 32, 33, 34, 35, 41, 46
47	2, 6, 12, 17, 20, 32, 34, 40, 41, 43, 46
48	1, 2, 7, 8, 11, 12, 20, 23
49	2, 3, 6, 7, 12, 13, 26, 27, 28, 30, 31, 32, 33, 34, 35, 41, 46
50	1, 2, 7, 8, 11, 12, 20, 23
51	2, 3, 6, 7, 12, 13, 26, 27, 28, 30, 31, 32, 33, 34, 35, 41, 46
52	2, 3, 6, 7, 12, 13, 26, 27, 28, 30, 31, 32, 33, 34, 35, 41, 46
53	1, 2, 7, 8, 11, 12, 20, 23
54	2, 3, 6, 7, 12, 13, 26, 27, 28, 30, 31, 32, 33, 34, 35, 41, 46
55	2, 6, 12, 17, 20, 32, 34, 40, 41, 43, 46
56	2, 3, 6, 7, 12, 13, 26, 27, 28, 30, 31, 32, 33, 34, 35, 41, 46
57	2, 3, 6, 7, 12, 13, 26, 27, 28, 30, 31, 32, 33, 34, 35, 41, 46
58	2, 3, 6, 7, 12, 13, 26, 27, 28, 30, 31, 32, 33, 34, 35, 41, 46
59	2, 6, 12, 17, 20, 32, 34, 40, 41, 43, 46
60	2, 6, 12, 17, 20, 32, 34, 40, 41, 43, 46

### Interview Examination Item Linkage

Exam Item #	KSAPC #
1	1, 2, 3, 4, 5, 6, 7, 8, 10, 12, 13, 14, 17, 19, 20, 21, 24, 25, 26, 28, 29, 32, 34, 35, 37, 38, 39, 40, 43, 45, 47, 52, 53, 56, 57, 62, 63, 67, 68, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82
2	8, 10, 34, 39, 40, 68, 78, 79, 82, 84
3	1, 2, 3, 5, 6, 8, 10, 13, 17, 19, 20, 21, 38, 39, 40, 56, 62, 68, 73, 75, 76, 77, 78, 79, 80, 81, 82, 84
4	43, 75, 80, 81, 84
5	1, 2, 3, 4, 5, 6, 7, 8, 10, 12, 13, 14, 17, 19, 20, 21, 24, 25, 26, 28, 29, 32, 34, 35, 37, 38, 39, 40, 43, 45, 47, 52, 53, 56, 57, 62, 63, 67, 68, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82

## APPENDIX E: Pass Point Data

### Written Examination

EXAMINATION ITEM #	MAC SCORE AVERAGE	TOTAL POSSIBLE	EXAMINATION ITEM #	MAC SCORE AVERAGE	TOTAL POSSIBLE
1	0.69	1	43	0.80	1
2	0.60	1	44	0.75	1
3	0.75	1	45	0.90	1
4	0.76	1	46	0.71	1
5	0.69	1	47	0.68	1
6	0.64	1	48	0.70	1
7	0.71	1	49	0.61	1
8	0.75	1	50	0.66	1
9	0.76	1	51	0.75	1
10	0.80	1	52	0.69	1
11	0.60	1	53	0.80	1
12	0.80	1	54	0.75	1
13	0.68	1	55	0.86	1
14	0.66	1	56	0.68	1
15	0.69	1	57	0.61	1
16	0.62	1	58	0.60	1
17	0.75	1	59	0.67	1
18	0.66	1	60	0.61	1
19	0.74	1	61	0.74	1
20	0.77	1	62	0.84	1
21	0.73	1	63	0.70	1
22	0.67	1	64	0.68	1
23	0.71	1	65	0.74	1
24	0.50	1	66	0.73	1
25	0.66	1	67	0.69	1
26	0.58	1	68	0.81	1
27	0.78	1	69	0.57	1
28	0.77	1	70	0.69	1
29	0.93	1	71	0.88	1
30	0.66	1	72	0.71	1
31	0.59	1	73	0.76	1
32	0.72	1	74	0.72	1
33	0.68	1	75	0.71	1
34	0.71	1	76	0.66	1
35	0.74	1	77	0.73	1
36	0.78	1	78	0.86	1
37	0.70	1	79	0.74	1
38	0.65	1	80	0.64	1
39	0.84	1	81	0.54	1
40	0.69	1	82	0.69	1
41	0.68	1	83	0.64	1
42	0.73	1	84	0.49	1

## Written Examination

EXAMINATION ITEM #	MAC SCORE AVERAGE	TOTAL POSSIBLE	EXAMINATION ITEM #	MAC SCORE AVERAGE	TOTAL POSSIBLE
85	0.82	1	123	0.83	1
86	0.64	1	124	0.69	1
87	0.61	1	125	0.69	1
88	0.61	1	126	0.64	1
89	0.69	1	127	0.66	1
90	0.69	1	128	0.63	1
91	0.69	1	129	0.81	1
92	0.72	1	130	0.69	1
93	0.69	1	131	0.66	1
94	0.69	1	132	0.74	1
95	0.66	1	133	0.74	1
96	0.66	1	134	0.82	1
97	0.70	1	135	0.81	1
98	0.69	1	136	0.64	1
99	0.71	1	137	0.83	1
100	0.79	1	138	0.74	1
101	0.74	1	139	0.74	1
102	0.69	1	140	0.68	1
103	0.68	1	141	0.63	1
104	0.72	1	142	0.65	1
105	0.56	1	143	0.90	1
106	0.61	1	144	0.74	1
107	0.70	1	145	0.79	1
108	0.69	1	146	0.67	1
109	0.74	1	147	0.83	1
110	0.70	1	148	0.83	1
111	0.70	1	149	0.71	1
112	0.76	1	150	0.71	1
113	0.66	1			
114	0.65	1			
115	0.88	1			
116	0.61	1			
117	0.66	1			
118	0.71	1			
119	0.62	1			
120	0.62	1		MAC Total	106.02
121	0.78	1		Total Poss.	150
122	0.65.	1		Pass Score	106

## Simulator Examination

EXAMINATION ITEM #	MAC SCORE AVERAGE	TOTAL POSSIBLE	EXAMINATION ITEM #	MAC SCORE AVERAGE	TOTAL POSSIBLE
1	0.98	2	31	0.46	2
2	0.69	2	32	0.67	2
3	1.13	2	33	1.27	2
4	0.96	2	34	0.79	2
5	0.73	2	35	0.19	2
6	1.02	2	36	1.44	2
7	0.69	2	37	1.35	2
8	1.31	2	38	0.73	2
9	0.81	2	39	0.71	2
10	0.83	2	40	0.90	2
11	0.15	2	41	1.15	2
12	1.17	2	42	0.58	2
13	0.48	2	43	1.02	2
14	0.79	2	44	1.08	2
15	1.25	2	45	1.02	2
16	0.88	2	46	1.46	2
17	1.23	2	47	0.79	2
18	0.21	2	48	0.65	2
19	1.29	2	49	0.69	2
20	1.06	2	50	0.92	2
21	0.85	2	51	0.79	2
22	0.92	2	52	0.75	2
23	0.96	2	53	0.92	2
24	1.27	2	54	0.54	2
25	1.23	2	55	1.02	2
26	1.10	2	56	0.88	2
27	0.88	2	57	0.94	2
28	0.65	2	58	0.96	2
29	1.19	2	59	1.15	2
30	1.13	2	60	1.40	2
				<b>MAC Total</b>	<b>55</b>
				<b>Total Poss.</b>	<b>120</b>
				<b>Pass Score</b>	<b>55</b>

## Interview Examination

EXAMINATION ITEM #	TOTAL POSSIBLE
1	21
2	21
3	21
4	21
5	21
<b>Total Poss.</b>	<b>105</b>